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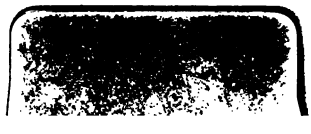

TABLES

FOR DETERMINING THE

CUBICAL CONTENT OF EARTHWORK,

IN THE

CONSTRUCTION

OF

RAILWAYS AND COMMON ROADS,

WHETHER IN

LEVEL GROUND OR SIDE CUTTING.

BY

WILLIAM KELLY.

DUBLIN:
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W. S. ORR & Co, 147 STRAND, LONDON.

1847.

Ft.	In.	Tabular Number	Ft.	In.	Tabular Number	Ft.	In.	Tabular Number	Ft.	In.	Tabular Number	Ft.	In.	Tabular Number	Ft.	In.	Tabular Number	Ft.	In.	Tabular Number
0	3	0·009	14	6	0·537	28	9	1·065	43	0	1·593	57	3	2·120	71	6	2·648	86	0	3·185
	6	0·019		9	0·546	29	0	1·074		3	1·602		6	2·130		9	2·657		3	3·194
	9	0·028	15	0	0·556		3	1·083		6	1·611		9	2·139	72	0	2·667		6	3·204
1	0	0·037		3	0·565		6	1·093		9	1·620	58	0	2·148		3	2·676		9	3·213
	3	0·046		6	0·574		9	1·102	44	0	1·630		3	2·157		6	2·685	87	0	3·222
	6	0·056		9	0·583	30	0	1·111		3	1·639		6	2·167		9	2·694		3	3·231
	9	0·065	16	0	0·593		3	1·120		6	1·648		9	2·176	73	0	2·704		6	3·241
2	0	0·074		3	0·602		6	1·130		9	1·657	59	0	2·185		3	2·713		9	3·250
	3	0·083		6	0·611		9	1·139	45	0	1·667		3	2·194		6	2·722	88	0	3·259
	6	0·093		9	0·620	31	0	1·148		3	1·676		6	2·204		9	2·731		3	3·268
	9	0·102	17	0	0·630		3	1·157		6	1·685		9	2·213	74	0	2·741		6	3·278
3	0	0·111		3	0·639		6	1·167		9	1·694	60	0	2·222		3	2·750		9	3·287
	3	0·120		6	0·648		9	1·176	46	0	1·704		3	2·231		6	2·759	89	0	3·296
	6	0·130		9	0·657	32	0	1·185		3	1·713		6	2·241		9	2·768		3	3·306
	9	0·139	18	0	0·667		3	1·194		6	1·722		9	2·250	75	0	2·778		6	3·315
4	0	0·148		3	0·676		6	1·204		9	1·731	61	0	2·259		3	2·787		9	3·324
	3	0·157		6	0·685		9	1·213	47	0	1·741		3	2·268		6	2·796	90	0	3·333
	6	0·167		9	0·694	33	0	1·222		3	1·750		6	2·278		9	2·805		3	3·343
	9	0·176	19	0	0·704		3	1·231		6	1·759		9	2·287	76	0	2·815		6	3·352
5	0	0·185		3	0·713		6	1·241		9	1·768	62	0	2·296		3	2·824		9	3·361
	3	0·194		6	0·722		9	1·250	48	0	1·778		3	2·306		6	2·833	91	0	3·370
	6	0·204		9	0·731	34	0	1·259		3	1·787		6	2·315		9	2·843		3	3·380
	9	0·213	20	0	0·741		3	1·268		6	1·796		9	2·324	77	0	2·852		6	3·389
6	0	0·222		3	0·750		6	1·278		9	1·805	63	0	2·333		3	2·861		9	3·398
	3	0·231		6	0·759		9	1·287	49	0	1·815		3	2·343		6	2·870	92	0	3·407
	6	0·241		9	0·768	35	0	1·296		3	1·824		6	2·352		9	2·880		3	3·417
	9	0·250	21	0	0·778		3	1·306		6	1·833		9	2·361	78	0	2·889		6	3·426
7	0	0·259		3	0·787		6	1·315		9	1·843	64	0	2·370		3	2·898		9	3·435
	3	0·268		6	0·796		9	1·324	50	0	1·852		3	2·380		6	2·907	93	0	3·444
	6	0·278		9	0·805	36	0	1·333		3	1·861		6	2·389		9	2·917		3	3·454
	9	0·287	22	0	0·815		3	1·343		6	1·870		9	2·398	79	0	2·926		6	3·463
8	0	0·296		3	0·824		6	1·352		9	1·880	65	0	2·407		3	2·935		9	3·472
	3	0·306		6	0·833		9	1·361	51	0	1·889		3	2·417		6	2·944	94	0	3·481
	6	0·315		9	0·843	37	0	1·370		3	1·898		6	2·426		9	2·954		3	3·491
	9	0·324	23	0	0·852		3	1·380		6	1·907		9	2·435	80	0	2·963		6	3·500
9	0	0·333		3	0·861		6	1·389		9	1·917	66	0	2·444		3	2·972		9	3·509
	3	0·343		6	0·870		9	1·398	52	0	1·926		3	2·454		6	2·981	95	0	3·519
	6	0·352		9	0·880	38	0	1·407		3	1·935		6	2·463		9	2·991		3	3·528
	9	0·361	24	0	0·889		3	1·417		6	1·944		9	2·472	81	0	3·000		6	3·537
10	0	0·370		3	0·898		6	1·426		9	1·954	67	0	2·481		3	3·009		9	3·546
	3	0·380		6	0·907		9	1·435	53	0	1·963		3	2·491		6	3·019	96	0	3·556
	6	0·389		9	0·917	39	0	1·444		3	1·972		6	2·500		9	3·028		3	3·565
	9	0·398	25	0	0·926		3	1·454		6	1·981		9	2·509	82	0	3·037		6	3·574
11	0	0·407		3	0·935		6	1·463		9	1·991	68	0	2·519		3	3·046		9	3·583
	3	0·417		6	0·944		9	1·472	54	0	2·000		3	2·528		6	3·056	97	0	3·593
	6	0·426		9	0·954	40	0	1·481		3	2·009		6	2·537		9	3·065		3	3·602
	9	0·435	26	0	0·963		3	1·491		6	2·019		9	2·546	83	0	3·074		6	3·611
12	0	0·444		3	0·972		6	1·500		9	2·028	69	0	2·556		3	3·083		9	3·620
	3	0·454		6	0·981		9	1·509	55	0	2·037		3	2·565		6	3·093	98	0	3·630
	6	0·463		9	0·991	41	0	1·519		3	2·046		6	2·574		9	3·102		3	3·639
	9	0·472	27	0	1·000		3	1·528		6	2·056		9	2·583	84	0	3·111		6	3·648
13	0	0·481		3	1·009		6	1·537		9	2·065	70	0	2·593		3	3·120		9	3·657
	3	0·491		6	1·019		9	1·546	56	0	2·074		3	2·602		6	3·130	99	0	3·667
	6	0·500		9	1·028	42	0	1·556		3	2·083		6	2·611		9	3·139		3	3·676
	9	0·509	28	0	1·037		3	1·565		6	2·093		9	2·620	85	0	3·148		6	3·685
14	0	0·519		3	1·046		6	1·574		9	2·102	71	0	2·630		3	3·157		9	3·694
	3	0·528		6	1·056		9	1·583	57	0	2·111		3	2·639		6	3·167	100		3·704
																9	3·176			

This Table referred to in p. 45 as occupying two pages, has been comprised in one.]

Table II.—SLOPE ¼ to 1.

Heights Ft.	In.	Base 1 Foot	Base 20 Feet	Base 30 Feet	Slopes
0	3	0·010	0·185	0·278	0·003
	6	0·019	0·370	0·556	0·005
	9	0·028	0·556	0·833	0·007
1	0	0·037	0·741	1·111	0·009
	3	0·046	0·926	1·389	0·012
	6	0·056	1·111	1·667	0·014
	9	0·065	1·296	1·944	0·017
2	0	0·074	1·481	2·222	0·019
	3	0·083	1·667	2·500	0·021
	6	0·093	1·852	2·778	0·023
	9	0·102	2·037	3·056	0·026
3	0	0·111	2·222	3.333	0·028
	3	0·120	2·407	3·611	0·030
	6	0·130	2·593	3·889	0·032
	9	0·139	2·778	4·167	0·035
4	0	0·148	2·963	4·444	0·037
	3	0·157	3·148	4·722	0·040
	6	0·167	3·333	5·000	0·042
	9	0·176	3·519	5·278	0·044
5	0	0·185	3·704	5·556	0·046
	3	0·194	3·889	5·833	0·049
	6	0·204	4·074	6·111	0·051
	9	0·213	4·259	6·389	0·054
6	0	0·222	4·444	6·667	0·056
	3	0 231	4·630	6·944	0 058
	6	0·241	4·815	7·222	0·060
	9	0·250	5·000	7·500	0·063
7	0	0·259	5·185	7·778	0·065
	3	0·268	5·370	8·056	0·067
	6	0·278	5·556	8·333	0·069
	9	0·287	5·741	8·611	0·072
8	0	0·296	5·926	8·889	0·074
	3	0·305	6·111	9·167	0·077
	6	0·315	6·296	9·444	0·079
	9	0·324	6·481	9·722	0·081
9	0	0·333	6·667	10·000	0·083
	3	0·342	6·852	10·278	0·086
	6	0·352	7·037	10·556	0·088
	9	0·361	7·222	10·833	0·091
10	0	0·370	7·407	11·111	0·093
	3	0·379	7·593	11·389	0·095
	6	0·389	7·778	11 667	0·097
	9	0·398	7·963	11·944	0·100
11	0	0·407	8·148	12·222	0·102
	3	0·416	8·333	12·500	0·104
	6	0·426	8·519	12·778	0·106
	9	0·435	8·704	13·056	0·109
12	0	0·444	8·889	13·333	0·111
	3	0·453	9·074	13·611	0·114
	6	0·463	9·259	13·889	0·116
	9	0·472	9·444	14·167	0·118
13	0	0·481	9·630	14·444	0·120
	3	0·490	9·815	14·722	0·123
	6	0·500	10·000	15·000	0·125
	9	0·509	10·185	15·278	0·128
14	0	0·519	10·370	15·556	0·130
	3	0·528	10·556	15·833	0·132
	6	0·537	10·741	16·111	0·134
	9	0·546	10·926	16·389	0·137
15	0	0·556	11·111	16·667	0·139
	3	0·565	11·296	16·944	0·142
	6	0·574	11·481	17·222	0·144
	9	0·583	11·667	17·500	0·146
16	0	0·593	11·852	17·778	0·148
	3	0·602	12·037	18·056	0·151
	6	0·611	12·222	18·333	0·153
	9	0·620	12·407	18·611	0·155
17	0	0·630	12·593	18·889	0·157
	3	0·639	12·778	19·167	0·160
	6	0·648	12·963	19·444	0·162
	9	0·657	13·148	19·722	0·165
18	0	0·667	13·333	20·000	0·167
	3	0·676	13·519	20·278	0·169
	6	0·685	13·704	20·556	0·171
	9	0·694	13·889	20·833	0·174
19	0	0·704	14·074	21·111	0·176
	3	0·713	14·259	21·389	0·179
	6	0·722	14·444	21·667	0·181
	9	0·731	14·630	21·944	0·183
20	0	0·741	14·815	22·222	0·185
	3	0·750	15·000	22·500	0·188
	6	0·759	15·185	22·778	0·190
	9	0·768	15·370	23·056	0·192
21	0	0·778	15·556	23·333	0·194
	3	0·787	15·741	23·611	0·197
	6	0·796	15·926	23·889	0·199
	9	0·805	16·111	24·167	0·202
22	0	0·815	16·296	24·444	0·204
	3	0 824	16·481	24·722	0·206
	6	0·833	16 667	25·000	0·208
	9	0·842	16·852	25·278	0 211
23	0	0·852	17·037	25 556	0·213
	3	0·861	17·222	25·833	0·216
	6	0·870	17·407	26·111	0·218
	9	0·879	17·593	26·389	0·220
24	0	0·889	17·778	26·667	0·222
	3	0·898	17·963	26·944	0·225
	6	0·907	18·148	27·222	0·227
	9	0 916	18·333	27·500	0·229
25	0	0·926	18·519	27·778	0·231
	3	0·935	18·704	28·056	0·234

Heights Ft.	In.	Base 1 Foot	Base 20 Feet	Base 30 Feet	Slopes
25	6	0·944	18·889	28.333	0·236
	9	0·953	19.074	28·611	0·239
26	0	0·963	19.259	28·889	0·241
	3	0·972	19·444	29·167	0·243
	6	0·981	19·630	29·444	0·245
	9	0·990	19·815	29·722	0·248
27	0	1·000	20·000	30·000	0·250
	3	1·009	20·185	30·278	0·253
	6	1·019	20·370	30·556	0·255
	9	1·028	20·556	30·833	0·257
28	0	1·037	20·741	31·111	0·259
	3	1·046	20·926	31·389	0·262
	6	1·056	21·111	31·667	0·264
	9	1·065	21·296	31·944	0·267
29	0	1·074	21·481	32·222	0·269
	3	1·083	21·667	32·500	0·271
	6	1·093	21·852	32·778	0·273
	9	1·102	22·037	33·056	0·276
30	0	1·111	22·222	33·333	0·278
	3	1·120	22·407	33·611	0·280
	6	1·130	22·593	33·889	0·282
	9	1·139	22·778	34·167	0·285
31	0	1·148	22·963	34·444	0·287
	3	1·157	23·148	34·722	0·290
	6	1·167	23.333	35·000	0·292
	9	1·176	23·519	35·278	0·294
32	0	1·185	23·704	35·556	0·296
	3	1·194	23·889	35·833	0·299
	6	1·204	24·074	36·111	0·301
	9	1·213	24·259	36·389	0·304
33	0	1·222	24·444	36·667	0·306
	3	1·231	24·630	36·944	0·308
	6	1·241	24·815	37·222	0·310
	9	1·250	25·000	37·500	0·313
34	0	1·259	25·185	37·778	0·315
	3	1·268	25·370	38·056	0·317
	6	1·278	25·556	38·333	0·319
	9	1·287	25·741	38·611	0·322
35	0	1·296	25·926	38·889	0·324
	3	1·305	26·111	39·167	0·327
	6	1·315	26·296	39·444	0·329
	9	1·324	26·481	39·722	0·331
36	0	1·333	26·667	40·000	0·333
	3	1·342	26·852	40·278	0·336
	6	1·352	27·037	40·556	0·338
	9	1·361	27·222	40·833	0.341
37	0	1·370	27·407	41·111	0·343
	3	1·379	27·593	41·389	0·345
	6	1·389	27·778	41·667	0·347
	9	1·398	27·963	41·944	0·350
38	0	1·407	28·148	42·222	0·352
	3	1·416	28·333	42·500	0·354
	6	1·426	28·519	42·778	0·356
	9	1·435	28·704	43·056	0·359
39	0	1·444	28·889	43·333	0·361
	3	1·453	29·074	43·611	0·364
	6	1·463	29·259	43·889	0·366
	9	1·472	29·444	44·167	0·368
40	0	1·481	29·630	44·444	0·370
	3	1·490	29·815	44·722	0·373
	6	1·500	30·000	45·000	0·375
	9	1·509	30·185	45·278	0·378
41	0	1·519	30·370	45·556	0·380
	3	1·528	30·556	45·833	0·382
	6	1·537	30·741	46·111	0·384
	9	1·546	30·926	46·389	0·387
42	0	1·556	31·111	46·667	0·389
	3	1·565	31·296	46·944	0·392
	6	1·574	31·481	47·222	0·394
	9	1·583	31·667	47·500	0·396
43	0	1·593	31·852	47·778	0·398
	3	1·602	32·037	48·056	0·401
	6	1·611	32·222	48·333	0·403
	9	1·620	32·407	48·611	0·405
44	0	1·630	32·593	48·889	0·407
	3	1·639	32·778	49·167	0·410
	6	1·648	32·963	49·444	0·412
	9	1·657	33·148	49·722	0·415
45	0	1·667	33·333	50·000	0·417
	3	1·676	33·519	50·278	0·419
	6	1·685	33·704	50·556	0·421
	9	1·694	33·889	50·833	0·424
46	0	1·704	34·074	51·111	0·426
	3	1·713	34·259	51·389	0·429
	6	1·722	34·444	51·667	0·431
	9	1·731	34·630	51·944	0·433
47	0	1·741	34·815	52·222	0·435
	3	1·750	35·000	52·500	0·438
	6	1·759	35·185	52·778	0·440
	9	1·768	35·370	53·056	0·442
48	0	1·778	35·556	53·333	0·444
	3	1·787	35·741	53·611	0·447
	6	1·796	35·926	53·889	0·449
	9	1·805	36·111	54·167	0·452
49	0	1·815	36·296	54·444	0·454
	3	1·824	36·481	54·722	0·456
	6	1·833	36·667	55·000	0·458
	9	1.842	36·852	55·278	0·461
50	0	1·852	37·037	55·556	0·463

TABLE II. Continued—SLOPE ½ to 1.

Heights Ft.	In.	Base 1 Foot	Base 20 Feet	Base 30 Feet	Slopes
0	3	0·010	0·185	0·278	0·005
	6	0·019	0·370	0·556	0·009
	9	0·028	0·556	0·833	0·014
1	0	0·037	0·741	1·111	0·019
	3	0·046	0·926	1·389	0·023
	6	0·056	1·111	1·667	0·028
	9	0·065	1·296	1·944	0·032
2	0	0·074	1·481	2·222	0·037
	3	0·083	1·667	2·500	0·041
	6	0·093	1·852	2·778	0·046
	9	0·102	2·037	3·056	0·051
3	0	0·111	2·222	3·333	0·056
	3	0·120	2·407	3·611	0·060
	6	0·130	2·593	3·889	0·065
	9	0·139	2·778	4·167	0·069
4	0	0·148	2·963	4·444	0·074
	3	0·157	3·148	4·722	0·078
	6	0·167	3·333	5·000	0·083
	9	0·176	3·519	5·278	0·088
5	0	0·185	3·704	5·556	0·093
	3	0·194	3·889	5·833	0·097
	6	0·204	4·074	6·111	0·102
	9	0·213	4·259	6·389	0·106
6	0	0·222	4·444	6·667	0·111
	3	0·231	4·630	6·944	0·115
	6	0·241	4·815	7·222	0·120
	9	0·250	5·000	7·500	0·125
7	0	0·259	5·185	7·778	0·130
	3	0·268	5·370	8·056	0·134
	6	0·278	5·556	8·333	0·139
	9	0·287	5·741	8·611	0·143
8	0	0·296	5·926	8·889	0·148
	3	0·305	6·111	9·167	0·152
	6	0·315	6·296	9·444	0·157
	9	0·324	6·481	9·722	0·162
9	0	0·333	6·667	10·000	0·167
	3	0·342	6·852	10·278	0·171
	6	0·352	7·037	10·556	0·176
	9	0·361	7·222	10·833	0·180
10	0	0·370	7·407	11·111	0·185
	3	0·379	7·593	11·389	0·189
	6	0·389	7·778	11·667	0·194
	9	0·398	7·963	11·944	0·199
11	0	0·407	8·148	12·222	0·204
	3	0·416	8·333	12.500	0·208
	6	0·426	8·519	12·778	0·213
	9	0·435	8·704	13·056	0·217
12	0	0·444	8·889	13·333	0·222
	3	0·453	9·074	13·611	0·226
	6	0·463	9·259	13·889	0·231
	9	0·472	9·444	14·167	0·236
13	0	0·481	9·630	14·444	0·241
	3	0·490	9·815	14·722	0·245
	6	0·500	10·000	15·000	0·250
	9	0·509	10·185	15·278	0·254
14	0	0·519	10·370	15·556	0·259
	3	0·528	10·556	15·833	0·264
	6	0·537	10·741	16·111	0·269
	9	0·546	10·926	16·389	0·273
15	0	0·556	11·111	16·667	0·278
	3	0·565	11·296	16·944	0·282
	6	0·574	11·481	17·222	0·287
	9	0·583	11·667	17·500	0·291
16	0	0·593	11·852	17·778	0·296
	3	0·602	12·037	18·056	0·301
	6	0·611	12·222	18·333	0·306
	9	0·620	12·407	18·611	0·310
17	0	0·630	12·593	18·889	0·315
	3	0·639	12·778	19·167	0·319
	6	0·648	12·963	19·444	0·324
	9	0·657	13·148	19·722	0·328
18	0	0·667	13·333	20·000	0·333
	3	0·676	13·519	20·278	0·338
	6	0·685	13·704	20·556	0·343
	9	0·694	13·889	20·833	0·347
19	0	0·704	14·074	21·111	0·352
	3	0·713	14·259	21·389	0·356
	6	0·722	14·444	21·667	0·361
	9	0·731	14·630	21·944	0·365
20	0	0·741	14·815	22·222	0·370
	3	0·750	15·000	22·500	0·375
	6	0·759	15·185	22·778	0·380
	9	0·768	15·370	23·056	0·384
21	0	0·778	15·556	23·333	0·389
	3	0·787	15·741	23·611	0·393
	6	0·796	15·926	23·889	0·398
	9	0·805	16·111	24·167	0·402
22	0	0·815	16·296	24·444	0·407
	3	0·824	16·481	24·722	0·412
	6	0·833	16·667	25·000	0·417
	9	0·842	16·852	25·278	0·421
23	0	0·852	17·037	25·556	0·426
	3	0·861	17·222	25·833	0·430
	6	0·870	17·407	26·111	0·435
	9	0·879	17·593	26·389	0·439
24	0	0·889	17·778	26·667	0·444
	3	0·898	17·963	26·944	0·449
	6	0·907	18·148	27·222	0·454
	9	0·916	18·333	27·500	0·45.
25	0	0·926	18·519	27·778	0·46:
	3	0·935	18·704	28·056.	0·467

Heights Ft.	In.	Base 1 Foot	Base 20 Feet	Base 30 Feet	Slopes
25	6	0·944	18·889	28·333	0·472
	9	0·953	19·074	28·611	0·476
26	0	0·963	19·259	28·889	0·481
	3	0·972	19·444	29·167	0·486
	6	0·981	19 630	29·444	0·491
	9	0·990	19·815	29·722	0·495
27	0	1·000	20·000	30·000	0·500
	3	1·009	20·185	30·278	0·504
	6	1·019	20·370	30·556	0·509
	9	1·028	20·556	30·833	0·514
28	0	1·037	20·741	31·111	0·519
	3	1·046	20·926	31·389	0·523
	6	1·056	21·111	31·667	0·528
	9	1·065	21·296	31·944	0·532
29	0	1·074	21·481	32·222	0·537
	3	1·083	21·667	32·500	0·541
	6	1·093	21·852	32·778	0·546
	9	1·102	22·037	33·056	0·551
30	0	1·111	22·222	33·333	0·556
	3	1·120	22·407	33·611	0·560
	6	1·130	22·593	33·889	0·565
	9	1·139	22·778	34·167	0·569
31	0	1·148	22·963	34·444	0·574
	3	1·157	23·148	34·722	0·578
	6	1·167	23·333	35·000	0·583
	9	1·176	23·519	35·278	0·588
32	0	1·185	23·704	35·556	0·593
	3	1·194	23·889	35·833	0·597
	6	1·204	24·074	36·111	0·602
	9	1·213	24·259	36·389	0·606
33	0	1·222	24·444	36·667	0·611
	3	1·231	24·630	36·944	0·615
	6	1·241	24·815	37·222	0·620
	9	1·250	25·000	37·500	0·625
34	0	1·259	25·185	37·778	0·630
	3	1·268	25·370	38·056	0·634
	6	1·278	25·556	38·333	0·639
	9	1·287	25·741	38·611	0·643
35	0	1·296	25·926	38·889	0·648
	3	1·305	26·111	39·167	0·652
	6	1·315	26·296	39·444	0·657
	9	1·324	26·481	39·722	0·662
36	0	1·333	26·667	40·000	0·667
	3	1·342	26·852	40·278	0·671
	6	1·352	27·037	40·556	0·676
	9	1·361	27·222	40·833	0·680
37	0	1·370	27·407	41·111	0·685
	3	1·379	27·593	41·389	0·689
	6	1·389	27·778	41·667	0·694
	9	1·398	27·963	41·944	0·699
38	0	1·407	28·148	42·222	0·704
	3	1·416	28·333	42·500	0·708
	6	1·426	28·519	42·778	0·713
	9	1·435	28·704	43·056	0·717
39	0	1·444	28·889	43·333	0·722
	3	1·453	29·074	43·611	0·726
	6	1·463	29·259	43·889	0·731
	9	1·472	29·444	44·167	0·736
40	0	1·481	29·630	44·444	0·741
	3	1·490	29·815	44·722	0·745
	6	1·500	30·000	45·009	0·750
	9	1·509	30·185	45·278	0·754
41	0	1·519	30·370	45·556	0·759
	3	1·528	30·556	45·833	0·764
	6	1·537	30·741	46·111	0·769
	9	1·546	30·926	46·389	0.773
42	0	1·556	31·111	46·667	0·778
	3	1·565	31·296	46·944	0.782
	6	1·574	31·481	47·222	0·787
	9	1·583	31·667	47·500	0·791
43	0	1·593	31·852	47·778	0·796
	3	1·602	32·037	48·056	0·801
	6	1·611	32·222	48·333	0·806
	9	1·620	32·407	48·611	0·810
44	0	1·630	32·593	48·889	0·815
	3	1·639	32·778	49·167	0·819
	6	1·648	32·963	49·444	0·824
	9	1·657	33·148	49·722	0·828
45	0	1·667	33·333	50·000	0·833
	3	1·676	33·519	50·278	0·838
	6	1·685	33·704	50·556	0·843
	9	1·694	33·889	50·833	0·847
46	0	1·704	34·074	51·111	0·852
	3	1·713	34·259	51·389	0·856
	6	1·722	34·444	51·667	0·861
	9	1·731	34·630	51·944	0·865
47	0	1·741	34·815	52·222	0·870
	3	1·750	35·000	52·500	0·875
	6	1·759	35·185	52·778	0·880
	9	1·768	35·370	53·056	0·884
48	0	1·778	35·556	53·333	0·889
	3	1·787	35·741	53·611	0·893
	6	1·796	35·926	53·889	0·898
	9	1·805	36·111	54·167	0·902
49	0	1·815	36·296	54·444	0·907
	3	1·824	36·481	54·722	0·912
	6	1·833	36·667	55·000	0·917
	9	1·842	36·852	55·278	0·921
50	0	1·852	37·037	55·556	0·926

TABLE II. Continued—SLOPE ¾ to 1.

Heights Ft.	In.	Base 1 Foot	Base 20 Feet	Base 30 Feet	Slopes
0	3	0.010	0·185	0·278	0·007
	6	0·019	0·370	0·556	0·014
	9	0·028	0·556	0·833	0·021
1	0	0·037	0·741	1·111	0·028
	3	0·046	0·926	1·389	0·035
	6	0·056	1·111	1·667	0·042
	9	0·065	1·296	1·944	0·049
2	0	0·074	1·481	2·222	0·056
	3	0·083	1·667	2·500	0·063
	6	0·093	1·852	2.778	0·069
	9	0·102	2·037	3·056	0·076
3	0	0·111	2·222	3·333	0·083
	3	0·120	2·407	3·611	0·090
	6	0·130	2·593	3·889	0·097
	9	0·139	2·778	4·167	0·104
4	0	0·148	2·963	4·444	0·111
	3	0·157	3·148	4·722	0·118
	6	0.167	3·333	5·000	0·125
	9	0·176	3.519	5·278	0·132
5	0	0·185	3·704	5·556	0·139
	3	0·194	3·889	5·833	0·146
	6	0·204	4·074	6·111	0·153
	9	0·213	4·259	6·389	0·160
6	0	0·222	4·444	6·667	0·167
	3	0·231	4·630	6·944	0·174
	6	0·241	4·815	7·222	0·181
	9	0·250	5.000	7·500	0·188
7	0	0·259	5·185	7·778	0·195
	3	0·268	5·370	8·056	0·201
	6	0·278	5·556	8·333	0·208
	9	0·287	5.741	8·611	0·215
8	0	0·296	5·926	8·889	0·222
	3	0·305	6·111	9·167	0·229
	6	0·315	6·296	9·444	0·236
	9	0·324	6·481	9·722	0·243
9	0	0·333	6·667	10·000	0·250
	3	0·342	6·852	10·278	0.257
	6	0·352	7·037	10·556	0·264
	9	0·361	7·222	10·833	0·271
10	0	0·370	7·407	11·111	0·278
	3	0·379	7·593	11·389	0·285
	6	0·389	7·778	11·667	0·292
	9	0·398	7·963	11·944	0·299
11	0	0·407	8·148	12·222	0·306
	3	0·416	8·333	12·500	0·313
	6	0·426	8·519	12·778	0·320
	9	0·435	8·704	13·056	0.326
12	0	0.444	8·889	13·333	0·333
	3	0·453	9·074	13·611	0·340
	6	0·463	9·259	13·889	0·347
	9	0·472	9·444	14·167	0·354
13	0	0·481	9·630	14·444	0·361
	3	0·490	9·815	14·722	0·368
	6	0·500	10·000	15.000	0·375
	9	0·509	10·185	15·278	0·382
14	0	0·519	10·370	15·556	0·389
	3	0·528	10·556	15·833	0·396
	6	0·537	10·741	16.111	0·403
	9	0·546	10·926	16·389	0·410
15	0	0·556	11·111	16·667	0·417
	3	0·565	11·296	16·944	0·424
	6	0·574	11·481	17·222	0·431
	9	0·583	11·667	17·500	0·438
16	0	0·593	11·852	17·778	0·445
	3	0·602	12·037	18·056	0.451
	6	0·611	12·222	18·333	0·458
	9	0·620	12·407	18·611	0·465
17	0	0·630	12·593	18·889	0·472
	3	0·639	12·778	19·167	0·479
	6	0·648	12·963	19·444	0·486
	9	0.657	13·148	19·722	0·493
18	0	0·667	13·333	20·000	0·500
	3	0.676	13·519	20·278	0·507
	6	0·685	13·704	20·556	0·514
	9	0·694	13·889	20·833	0·521
19	0	0·704	14·074	21·111	0·528
	3	0·713	14·259	21·389	0·535
	6	0·722	14·444	21·667	0·542
	9	0·731	14·630	21·944	0·549
20	0	0·741	14·815	22·222	0·556
	3	0·750	15·000	22·500	0·563
	6	0·759	15·185	22·778	0·570
	9	0·768	15·370	23·056	0·576
21	0	0·778	15·556	23·333	0·583
	3	0·787	15·741	23·611	0·590
	6	0·796	15·926	23·889	0·597
	9	0·805	16·111	24·167	0·604
22	0	0·815	16·296	24·444	0·611
	3	0·824	16·481	24·722	0·618
	6	0·833	16·667	25.000	0·625
	9	0·842	16·852	25·278	0·632
23	0	0·852	17·037	25·556	0·639
	3	0·861	17·222	25·833	0·646
	6	0·870	17·407	26·111	0·653
	9	0·879	17·593	26·389	0·660
24	0	0·889	17·778	26·667	0·667
	3	0·898	17·963	26·944	0·674
	6	0·907	18·148	27·222	0·681
	9	0·916	18.333	27·500	0·688
25	0	0·926	18·519	27·778	0·695
	3	0·935	18·704	28·056	0·701

Heights Ft.	In	Base 1 Foot	Base 20 Feet	Base 30 Feet	Slopes
25	6	0·944	18·889	28·333	0·708
	9	0·953	19·074	28·611	0·715
26	0	0·963	19·259	28·889	0·722
	3	0·972	19·444	29·167	0·729
	6	0·981	19·630	29·444	0·736
	9	0·990	19·815	29·722	0·743
27	0	1·000	20·000	30·000	0·750
	3	1·009	20·185	30·278	0·757
	6	1·019	20·370	30·556	0·764
	9	1·028	20·556	30·833	0·771
28	0	1·037	20·741	31·111	0·778
	3	1·046	20·926	31·389	0·785
	6	1·056	21·111	31·667	0·792
	9	1·065	21·296	31·944	0·799
29	0	1·074	21·481	32·222	0·806
	3	1·083	21·667	32·500	0·813
	6	1·093	21·852	32·778	0·820
	9	1·102	22·037	33·056	0·826
30	0	1·111	22·222	33·333	0·833
	3	1·120	22·407	33·611	0·840
	6	1·130	22·593	33·889	0·847
	9	1·139	22·778	34·167	0·854
31	0	1·148	22·963	34·444	0·861
	3	1·157	23·148	34·722	0·868
	6	1·167	23·333	35·000	0·875
	9	1·176	23·519	35·278	0·882
32	0	1·185	23·704	35·556	0·889
	3	1·194	23·889	35·833	0·896
	6	1·204	24·074	36·111	0·903
	9	1·213	24·259	36·389	0·910
33	0	1·222	24·444	36·667	0·917
	3	1·231	24·630	36·944	0·924
	6	1·241	24·815	37·222	0·931
	9	1·250	25·000	37·500	0·938
34	0	1·259	25·185	37·778	0·945
	3	1·268	25·370	38·056	0·951
	6	1·278	25·556	38·333	0·958
	9	1·287	25·741	38·611	0·965
35	0	1·296	25·926	38·889	0·972
	3	1·305	26·111	39·167	0·979
	6	1·315	26·296	39·444	0·986
	9	1·324	26·481	39·722	0·993
36	0	1·333	26·667	40·000	1·000
	3	1·342	26·852	40·278	1·007
	6	1·352	27·037	40·556	1·014
	9	1·361	27·222	40·833	1·021
37	0	1·370	27·407	41·111	1·028
	3	1·379	27·593	41·389	1·035
	6	1·389	27·778	41·667	1·042
	9	1·398	27·963	41·944	1·049
38	0	1·407	28·148	42·222	1·056
	3	1·416	28·333	42·500	1·063
	6	1·426	28·519	42·778	1·070
	9	1·435	28·704	43·056	1·076
39	0	1·444	28·889	43·333	1·083
	3	1·453	29·074	43·611	1·090
	6	1·463	29·259	43·889	1·097
	9	1·472	29·444	44·167	1·104
40	0	1·481	29·630	44·444	1·111
	3	1·490	29·815	44·722	1·118
	6	1·500	30·000	45·000	1·125
	9	1·509	30·185	45·278	1·132
41	0	1·519	30·370	45·556	1·139
	3	1·528	30·556	45·833	1·146
	6	1·537	30·741	46·111	1·153
	9	1·546	30·926	46·389	1·160
42	0	1·556	31·111	46·667	1·167
	3	1·565	31·296	46·944	1·174
	6	1·574	31·481	47·222	1·181
	9	1·583	31·667	47·500	1·188
43	0	1·593	31·852	47·778	1·195
	3	1·602	32·037	48·056	1·201
	6	1·611	32·222	48·333	1·208
	9	1·620	32·407	48·611	1·215
44	0	1·630	32·593	48·889	1·222
	3	1·639	32·778	49·167	1·229
	6	1·648	32·963	49·444	1·236
	9	1·657	33·148	49·722	1·243
45	0	1·667	33·333	50·000	1·250
	3	1·676	33·519	50·278	1·257
	6	1·685	33·704	50·556	1·264
	9	1·694	33·889	50·833	1·271
46	0	1·704	34·074	51·111	1·278
	3	1·713	34·259	51·389	1·285
	6	1·722	34·444	51·667	1·292
	9	1·731	34·630	51·944	1·299
47	0	1·741	34·815	52·222	1·306
	3	1·750	35·000	52·500	1·313
	6	1·759	35·185	52·778	1·320
	9	1·768	35·370	53·056	1·326
48	0	1·778	35·556	53·333	1·333
	3	1·787	35·741	53·611	1·340
	6	1·796	35·926	53·889	1·347
	9	1·805	36·111	54·167	1·354
49	0	1·815	36·296	54·444	1·361
	3	1·824	36·481	54·722	1·368
	6	1·833	36·667	55·000	1·375
	9	1·842	36·852	55·278	1·382
50	0	1·852	37·037	55·556	1·389

Table II. Continued—SLOPE 1 to 1.

Heights Ft.	In.	Base 1 Foot	Base 20 Feet	Base 30 Feet	Slopes
0	3	0·010	0·185	0·278	0·010
	6	0·019	0·370	0·556	0·019
	9	0·028	0·556	0·833	0·028
1	0	0·037	0·741	1·111	0·037
	3	0·046	0·926	1·389	0·046
	6	0·056	1·111	1·667	0·056
	9	0·065	1·296	1·944	0·065
2	0	0·074	1·481	2·222	0·074
	3	0·083	1·667	2·500	0·083
	6	0·093	1·852	2·778	0·093
	9	0·102	2·037	3·056	0·102
3	0	0·111	2·222	3·333	0·111
	3	0·120	2·407	3·611	0·120
	6	0·130	2·593	3·889	0·130
	9	0·139	2·778	4·167	0·139
4	0	0·148	2·963	4·444	0·148
	3	0·157	3·148	4·722	0·157
	6	0·167	3·333	5·000	0·167
	9	0·176	3·519	5·278	0·176
5	0	0·185	3·704	5·556	0·185
	3	0·194	3·889	5·833	0·194
	6	0·204	4·074	6·111	0·204
	9	0·213	4·259	6·389	0·213
6	0	0·222	4·444	6·667	0·222
	3	0·231	4·630	6·944	0·231
	6	0·241	4·815	7·222	0·241
	9	0·250	5·000	7·500	0·250
7	0	0·259	5·185	7·778	0·259
	3	0·268	5·370	8·056	0·268
	6	0·278	5·556	8·333	0·278
	9	0·287	5·741	8·611	0·287
8	0	0·296	5·926	8·889	0·296
	3	0·305	6·111	9·167	0·305
	6	0·315	6·296	9·444	0·315
	9	0·324	6·481	9·722	0·324
9	0	0·333	6·667	10·000	0·333
	3	0·342	6·852	10·278	0·342
	6	0·352	7·037	10·556	0·352
	9	0·361	7·222	10·833	0·361
10	0	0·370	7·407	11·111	0·370
	3	0·379	7·593	11·389	0·379
	6	0·389	7·778	11·667	0·389
	9	0·398	7·963	11·944	0·398
11	0	0·407	8·148	12·222	0·407
	3	0·416	8·333	12·500	0·416
	6	0·426	8·519	12·778	0·426
	9	0·435	8·704	13·056	0·435
12	0	0·444	8·889	13·333	0·444
	3	0·453	9·074	13·611	0·453
	6	0·463	9·259	13·889	0·463
	9	0·472	9·444	14·167	0·472
13	0	0·481	9·630	14·444	0·481
	3	0·490	9·815	14·722	0·490
	6	0·500	10·000	15·000	0·500
	9	0·509	10·185	15·278	0·509
14	0	0·519	10·370	15·556	0·519
	3	0·528	10·556	15·833	0·528
	6	0·537	10·741	16·111	0·537
	9	0·546	10·926	16·389	0·546
15	0	0·556	11·111	16·667	0·556
	3	0·565	11·296	16·944	0·565
	6	0·574	11·481	17·222	0·574
	9	0·583	11·667	17·500	0·583
16	0	0·593	11·852	17·778	0·593
	3	0·602	12·037	18·056	0·602
	6	0·611	12·222	18·333	0·611
	9	0·620	12·407	18·611	0·620
17	0	0·630	12·593	18·889	0·630
	3	0·639	12·778	19·167	0·639
	6	0·648	12·963	19·444	0·648
	9	0·657	13·148	19·722	0·657
18	0	0·667	13·333	20·000	0·667
	3	0·676	13·519	20·278	0·676
	6	0·685	13·704	20·556	0·685
	9	0·694	13·889	20·833	0·694
19	0	0·704	14·074	21·111	0·704
	3	0·713	14·259	21·389	0·713
	6	0·722	14·444	21·667	0·722
	9	0·731	14·630	21·944	0·731
20	0	0·741	14·815	22·222	0·741
	3	0·750	15·000	22·500	0·750
	6	0·759	15·185	22·778	0·759
	9	0·768	15·370	23·056	0·768
21	0	0·778	15·556	23·333	0·778
	3	0·787	15·741	23·611	0·787
	6	0·796	15·926	23·889	0·796
	9	0·805	16·111	24·167	0·805
22	0	0·815	16·296	24·444	0·815
	3	0·824	16·481	24·722	0·824
	6	0·833	16·667	25·000	0·833
	9	0·842	16·852	25·278	0·842
23	0	0·852	17·037	25·556	0·852
	3	0·861	17·222	25·833	0·861
	6	0·870	17·407	26·111	0·870
	9	0·879	17·593	26·389	0·879
24	0	0·889	17·778	26·667	0·889
	3	0·898	17·963	26·944	0·898
	6	0·907	18·148	27·222	0·907
	9	0·916	18·333	27·500	0·916
25	0	0·926	18·519	27·778	0·926
	3	0·935	18·704	28·056	0·935

Heights Ft. In	Base 1 Foot	Base 20 Feet	Base 30 Feet	Slopes
25 6	0.944	18·889	28·333	0·944
9	0·953	19·074	28·611	0·953
26 0	0·963	19·259	28·889	0·963
3	0·972	19·444	29·167	0·972
6	0·981	19·630	29·444	0·981
9	0·990	19·815	29·722	0·990
27 0	1·000	20·000	30·000	1·000
3	1·009	20·185	30·278	1·009
6	1·019	20·370	30·556	1·019
9	1·028	20·556	30·833	1·028
28 0	1·037	20·741	31·111	1·037
3	1·046	20·926	31·389	1·046
6	1·056	21·111	31·667	1·056
9	1·065	21·296	31·944	1·065
29 0	1·074	21·481	32·222	1·074
3	1·083	21·667	32·500	1·083
6	1·093	21·852	32·778	1·093
9	1·102	22·037	33·056	1·102
30 0	1·111	22·222	33·333	1·111
3	1·120	22·407	33·611	1·120
6	1·130	22·593	33·889	1·130
9	1·139	22·778	34·167	1·139
31 0	1·148	22·963	34·444	1·148
3	1·157	23·148	34·722	1·157
6	1·167	23·333	35·000	1·167
9	1·176	23·519	35·278	1·176
32 0	1·185	23·704	35·556	1·185
3	1·194	23·889	35·833	1·194
6	1·204	24·074	36·111	1·204
9	1·213	24·259	36·389	1·213
33 0	1·222	24·444	36·667	1·222
3	1·231	24·630	36·944	1·231
6	1·241	24·815	37·222	1·241
9	1·250	25·000	37·500	1·250
34 0	1·259	25·185	37·778	1·259
3	1·268	25·370	38·056	1·268
6	1·278	25·556	38·333	1.278
9	1·287	25·741	38·611	1·287
35 0	1·296	25·926	38·889	1·296
3	1·305	26·111	39·167	1·305
6	1·315	26·296	39·444	1·315
9	1·324	26·481	39·722	1·324
36 0	1·333	26·667	40·000	1·333
3	1·342	26·852	40·278	1·342
6	1·352	27·037	40·556	1·352
9	1·361	27·222	40·833	1·361
37 0	1·370	27·407	41·111	1·370
3	1·379	27·593	41·389	1·379
6	1·389	27·778	41·667	1·389
9	1·398	27·963	41·944	1·398
38 0	1·407	28·148	42·222	1·407
3	1·416	28·333	42·500	1·416
6	1·426	28·519	42·778	1·426
9	1·435	28·704	43·056	1·435
39 0	1·444	28·889	43·333	1·444
3	1·453	29·074	43·611	1·453
6	1·463	29·259	43·889	1·463
9	1·472	29·444	44·167	1·472
40 0	1·481	29·630	44·444	1·481
3	1·490	29·815	44·722	1·490
6	1·500	30·000	45·000	1·500
9	1·509	30·185	45·278	1·509
41 0	1·519	30·370	45·556	1·519
3	1·528	30·556	45·833	1·528
6	1·537	30·741	46·111	1·537
9	1·546	30·926	46·389	1·546
42 0	1·556	31·111	46·667	1·556
3	1·565	31·296	46·944	1·565
6	1·574	31·481	47·222	1·574
9	1·583	31·667	47·500	1·583
43 0	1·593	31·852	47·778	1·593
3	1·602	32·037	48·056	1·602
6	1·611	32·222	48·333	1·611
9	1·620	32·407	48·611	1·620
44 0	1·630	32·593	48·889	1·630
3	1·639	32·778	49·167	1·639
6	1·648	32·963	49·444	1·648
9	1·657	33·148	49·722	1·657
45 0	1·667	33 333	50·000	1·667
3	1·676	33·519	50·278	1·676
6	1·685	33·704	50·556	1·685
9	1·694	33·889	50·833	1·694
46 0	1·704	34·074	51·111	1·704
3	1·713	34·259	51·389	1·713
6	1·722	34·444	51·667	1·722
9	1·731	34·630	51·944	1·731
47 0	1·741	34·815	52·222	1·741
3	1·750	35·000	52·500	1·750
6	1·759	35·185	52·778	1·759
9	1·768	35·370	53·056	1·768
48 0	1·778	35·556	53·333	1·778
3	1·787	35·741	53·611	1·787
6	1·796	35·926	53·889	1·796
9	1·805	36·111	54·167	1·805
49 0	1·815	36·296	54·444	1·815
3	1·824	36·481	54·722	1·824
6	1·833	36·667	55·000	1·833
9	1·842	36·852	55·278	1·842
50 0	1·852	37·037	55·556	1·852

Heights Ft.	In.	Base 1 Foot	Base 20 Feet	Base 30 Feet	Slopes
0	3	0·010	0·185	0·278	0·012
	6	0·019	0·370	0·556	0·023
	9	0·028	0.556	0·833	0·035
1	0	0·037	0·741	1·111	0·046
	3	0·046	0·926	1·389	0·057
	6	0·056	1·111	1·667	0·069
	9	0·065	1·296	1·944	0·081
2	0	0·074	1·481	2·222	0·092
	3	0·083	1.667	2·500	0·104
	6	0·093	1·852	2·778	0·116
	9	0·102	2·037	3·056	0·128
3	0	0·111	2·222	3·333	0·139
	3	0·120	2·407	3·611	0·151
	6	0·130	2·593	3·889	0·162
	9	0·139	2·778	4·167	0·174
4	0	0·148	2·963	4·444	0·185
	3	0·157	3·148	4·722	0·197
	6	0·167	3·333	5·000	0·208
	9	0·176	3·519	5·278	0·220
5	0	0·185	3·704	5·556	0·231
	3	0·194	3·889	5·833	0·243
	6	0·204	4·074	6·111	0·255
	9	0·213	4·259	6·389	0·267
6	0	0·222	4·444	6·667	0·278
	3	0·231	4·630	6·944	0·290
	6	0·241	4·815	7·222	0·301
	9	0·250	5·000	7·500	0·313
7	0	0·259	5·185	7·778	0·324
	3	0·268	5·370	8·056	0·336
	6	0·278	5·556	8·333	0·347
	9	0·287	5·741	8·611	0·359
8	0	0·296	5·926	8·889	0·370
	3	0·305	6·111	9·167	0·382
	6	0·315	6·296	9·444	0·394
	9	0.324	6·481	9.722	0·406
9	0	0·333	6.667	10·000	0·417
	3	0·342	6·852	10·278	0·429
	6	0·352	7·037	10·556	0·440
	9	0·361	7·222	10·833	0·452
10	0	0·370	7·407	11·111	0·463
	3	0·379	7·593	11·389	0·475
	6	0·389	7·778	11·667	0·486
	9	0·398	7·963	11·944	0·498
11	0	0·407	8·148	12·222	0·509
	3	0·416	8·333	12·500	0·521
	6	0·426	8·519	12·778	0·532
	9	0·435	8·704	13·056	0·544
12	0	0·444	8·889	13·333	0·556
	3	0·453	9·074	13·611	0·568
	6	0·463	9·259	13·889	0·579
	9	0·472	9·444	14·167	0·591
13	0	0·481	9·630	14·444	0·602
	3	0·490	9·815	14·722	0·614
	6	0·500	10·000	15·000	0·625
	9	0·509	10·185	15·278	0·637
14	0	0·519	10·370	15·556	0·648
	3	0·528	10·556	15·833	0·660
	6	0·537	10·741	16·111	0·671
	9	0·546	10·926	16·389	0·683
15	0	0·556	11·111	16·667	0·694
	3	0·565	11·296	16·944	0·706
	6	0·574	11·481	17·222	0·718
	9	0·583	11·667	17·500	0·730
16	0	0·593	11·852	17·778	0·741
	3	0·602	12·037	18·056	0·753
	6	0·611	12·222	18·333	0·764
	9	0·620	12·407	18·611	0·776
17	0	0·630	12·593	18·889	0·787
	3	0·639	12·778	19·167	0·799
	6	0·648	12·963	19·444	0·810
	9	0·657	13·148	19·722	0·822
18	0	0·667	13·333	20·000	0·833
	3	0·676	13·519	20·278	0·845
	6	0·685	13·704	20·556	0·856
	9	0·694	13·889	20·833	0·868
19	0	0·704	14·074	21·111	0·880
	3	0·713	14·259	21·389	0·892
	6	0·722	14·444	21·667	0·903
	9	0·731	14·630	21·944	0·915
20	0	0·741	14·815	22·222	0·926
	3	0·750	15·000	22·500	0·938
	6	0·759	15·185	22·778	0·949
	9	0·768	15·370	23·056	0·961
21	0	0·778	15·556	23·333	0·972
	3	0·787	15·741	23·611	0·984
	6	0·796	15·926	23·889	0·995
	9	0·805	16·111	24·167	1·007
22	0	0·815	16·296	24·444	1·019
	3	0·824	16.481	24·722	1·031
	6	0·833	16·667	25·000	1·042
	9	0·842	16·852	25·278	1·054
23	0	0·852	17·037	25·556	1·065
	3	0·861	17·222	25·833	1·077
	6	0·870	17·407	26·111	1·088
	9	0·879	17·593	26·389	1·100
24	0	0·889	17·778	26.667	1·111
	3	0·898	17·963	26·944	1·123
	6	0·907	18·148	27·222	1·134
	9	0·916	18·333	27·500	1·146
25	0	0·926	18·519	27·778	1·157
	3	0·935	18·704	28·056	1·169

Heights Ft.	In.	Base 1 Foot	Base 20 Feet	Base 30 Feet	Slopes
25	6	0·944	18·889	28.333	1·181
	9	0·953	19.074	28·611	1·193
26	0	0·963	19.259	28·889	1·204
	3	0·972	19·444	29·167	1·216
	6	0·981	19·630	29·444	1·227
	9	0·990	19·815	29·722	1·239
27	0	1·000	20·000	30·000	1·250
	3	1·009	20·185	30·278	1·262
	6	1·019	20·370	30·556	1·273
	9	1·028	20·556	30·833	1·285
28	0	1·037	20·741	31·111	1·296
	3	1·046	20·926	31·389	1·308
	6	1·056	21·111	31·667	1·319
	9	1·065	21·296	31·944	1·331
29	0	1·074	21·481	32·222	1·343
	3	1·083	21·667	32·500	1·355
	6	1·093	21·852	32·778	1·366
	9	1·102	22·037	33·056	1·378
30	0	1·111	22·222	33·333	1·389
	3	1·120	22·407	33·611	1·401
	6	1·130	22·593	33·889	1·412
	9	1·139	22·778	34·167	1·424
31	0	1·148	22·963	34·444	1·435
	3	1·157	23·148	34·722	1·447
	6	1·167	23.333	35·000	1·458
	9	1·176	23·519	35·278	1·470
32	0	1·185	23·704	35·556	1·481
	3	1·194	23·889	35·833	1·493
	6	1·204	24·074	36·111	1·505
	9	1·213	24·259	36·389	1·517
33	0	1·222	24·444	36·667	1·528
	3	1·231	24·630	36·944	1·540
	6	1·241	24·815	37·222	1·551
	9	1·250	25·000	37·500	1·563
34	0	1·259	25·185	37·778	1·574
	3	1·268	25·370	38·056	1·586
	6	1·278	25·556	38·333	1·597
	9	1·287	25·741	38·611	1·609
35	0	1·296	25·926	38·889	1·620
	3	1·305	26·111	39·167	1·632
	6	1·315	26·296	39·444	1·644
	9	1·324	26·481	39·722	1·656
36	0	1·333	26·667	40·000	1·667
	3	1·342	26·852	40·278	1·679
	6	1·352	27·037	40·556	1·690
	9	1·361	27·222	40·833	1.702
37	0	1·370	27·407	41·111	1·713
	3	1·379	27·593	41·389	1·725
	6	1·389	27·778	41·667	1·736
	9	1·398	27·963	41·944	1·748
38	0	1·407	28·148	42·222	1·759
	3	1·416	28·333	42·500	1·771
	6	1·426	28·519	42·778	1·782
	9	1·435	28·704	43·056	1·794
39	0	1·444	28·889	43·333	1·806
	3	1·453	29·074	43·611	1·818
	6	1·463	29·259	43·889	1·829
	9	1·472	29·444	44·167	1·841
40	0	1·481	29·630	44·444	1·852
	3	1·490	29·815	44·722	1·864
	6	1·500	30·000	45·000	1·875
	9	1·509	30·185	45·278	1·887
41	0	1·519	30·370	45·556	1·898
	3	1·528	30·556	45·833	1·910
	6	1·537	30·741	46·111	1·921
	9	1·546	30·926	46·389	1·933
42	0	1·556	31·111	46·667	1·944
	3	1·565	31·296	46·944	1·956
	6	1·574	31·481	47·222	1·968
	9	1·583	31·667	47·500	1·980
43	0	1·593	31·852	47·778	1·991
	3	1·602	32·037	48·056	2·003
	6	1·611	32·222	48·333	2·014
	9	1·620	32·407	48·611	2·026
44	0	1·630	32·593	48·889	2·037
	3	1·639	32·778	49·167	2·049
	6	1·648	32·963	49·444	2·060
	9	1·657	33·148	49·722	2·072
45	0	1·667	33·333	50·000	2·083
	3	1·676	33·519	50·278	2·095
	6	1·685	33·704	50·556	2·106
	9	1·694	33·889	50·833	2·118
46	0	1·704	34·074	51·111	2·130
	3	1·713	34·259	51·389	2·142
	6	1·722	34·444	51·667	2·153
	9	1·731	34·630	51·944	2·165
47	0	1·741	34·815	52·222	2·176
	3	1·750	35·000	52·500	2·188
	6	1·759	35·185	52·778	2·199
	9	1·768	35·370	53·056	2·211
48	0	1·778	35·556	53·333	2·222
	3	1·787	35·741	53·611	2·234
	6	1·796	35·926	53·889	2·245
	9	1·805	36·111	54·167	2·257
49	0	1·815	36·296	54·444	2·269
	3	1·824	36·481	54·722	2·281
	6	1·833	36·667	55·000	2·292
	9	1.842	36·852	55·278	2·304
50	0	1·852	37·037	55·556	2·315

TABLE II. Continued—SLOPE 2½ to 1.

Heights Ft.	In.	BASE 1 Foot	BASE 20 Feet	BASE 30 Feet	SLOPES
0	3	0·010	0·185	0·278	0·023
	6	0·019	0·370	0·556	0·046
	9	0·028	0·556	0·833	0·070
1	0	0·037	0·741	1·111	0·093
	3	0·046	0·926	1·389	0·116
	6	0·056	1·111	1·667	0·139
	9	0·065	1·296	1·944	0·162
2	0	0·074	1·481	2·222	0·185
	3	0·083	1·667	2·500	0·208
	6	0·093	1·852	2·778	0·231
	9	0·102	2·037	3·056	0·255
3	0	0·111	2·222	3·333	0·278
	3	0·120	2·407	3·611	0·301
	6	0·130	2·593	3·889	0·324
	9	0·139	2·778	4·167	0·347
4	0	0·148	2·963	4·444	0·370
	3	0·157	3·148	4·722	0·394
	6	0·167	3·333	5·000	0·417
	9	0·176	3·519	5·278	0·440
5	0	0·185	3·704	5·556	0·463
	3	0·194	3·889	5·833	0·486
	6	0·204	4·074	6·111	0·509
	9	0·213	4·259	6·389	0·533
6	0	0·222	4·444	6·667	0·556
	3	0·231	4·630	6·944	0·579
	6	0·241	4·815	7·222	0·602
	9	0·250	5·000	7·500	0·625
7	0	0·259	5·185	7·778	0·648
	3	0·268	5·370	8·056	0·671
	6	0·278	5·556	8·333	0·694
	9	0·287	5·741	8·611	0·718
8	0	0·296	5·926	8·889	0·741
	3	0·305	6·111	9·167	0·764
	6	0·315	6·296	9·444	0·787
	9	0·324	6·481	9·722	0·810
9	0	0·333	6·667	10·000	0·833
	3	0·342	6·852	10·278	0·857
	6	0·352	7·037	10·556	0·880
	9	0·361	7·222	10·833	0·903
10	0	0·370	7·407	11·111	0·926
	3	0·379	7·593	11·389	0·949
	6	0·389	7·778	11·667	0·972
	9	0·398	7·963	11·944	0·996
11	0	0·407	8·148	12·222	1·019
	3	0·416	8·333	12.500	1·042
	6	0·426	8·519	12·778	1·065
	9	0·435	8·704	13·056	1·088
12	0	0·444	8·889	13·333	1·111
	3	0·453	9·074	13·611	1·134
	6	0·463	9·259	13·889	1·157
	9	0·472	9·444	14·167	1·181
13	0	0·481	9·630	14·444	1·204
	3	0·490	9·815	14·722	1·227
	6	0·500	10·000	15·000	1·250
	9	0·509	10·185	15·278	1·273
14	0	0·519	10·370	15·556	1·296
	3	0·528	10·556	15·833	1·320
	6	0·537	10·741	16·111	1·343
	9	0·546	10·926	16·389	1·366
15	0	0·556	11·111	16·667	1·389
	3	0·565	11·296	16·944	1·412
	6	0·574	11·481	17·222	1·435
	9	0·583	11·667	17·500	1·458
16	0	0·593	11·852	17·778	1·481
	3	0·602	12·037	18·056	1·505
	6	0·611	12·222	18·333	1·528
	9	0·620	12·407	18·611	1·551
17	0	0·630	12·593	18·889	1·574
	3	0·639	12·778	19·167	1·597
	6	0·648	12·963	19·444	1·620
	9	0·657	13·148	19·722	1·644
18	0	0·667	13·333	20·000	1·667
	3	0·676	13·519	20·278	1·690
	6	0·685	13·704	20·556	1·713
	9	0·694	13·889	20·833	1·736
19	0	0·704	14·074	21·111	1·759
	3	0·713	14·259	21·389	1·783
	6	0·722	14·444	21·667	1·806
	9	0·731	14·630	21·944	1·829
20	0	0·741	14·815	22·222	1·852
	3	0·750	15·000	22·500	1·875
	6	0·759	15·185	22·778	1·898
	9	0·768	15·370	23·056	1·921
21	0	0·778	15·556	23·333	1·944
	3	0·787	15·741	23·611	1·968
	6	0·796	15·926	23·889	1·991
	9	0·805	16·111	24·167	2·014
22	0	0·815	16·296	24·444	2·037
	3	0·824	16·481	24·722	2·060
	6	0·833	16·667	25·000	2·083
	9	0·842	16·852	25·278	2·107
23	0	0·852	17·037	25·556	2·130
	3	0·861	17·222	25·833	2·153
	6	0·870	17·407	26·111	2·176
	9	0·879	17·593	26·389	2·199
24	0	0·889	17·778	26·667	2·222
	3	0·898	17·963	26·944	2·246
	6	0·907	18·148	27·222	2·269
	9	0·916	18·333	27·500	2·292
25	0	0·926	18·519	27·778	2·315
	3	0·935	18·704	28·056	2·338

Heights Ft.	In.	Base 1 Foot	Base 20 Feet	Base 30 Feet	Slopes
25	6	0·944	18·889	28·333	2·361
	9	0·953	19·074	28·611	2·384
26	0	0·963	19·259	28·889	2·407
	3	0·972	19·444	29·167	2·431
	6	0·981	19·630	29·444	2·454
	9	0·990	19·815	29·722	2·477
27	0	1·000	20·000	30·000	2·500
	3	1·009	20·185	30·278	2·523
	6	1·019	20·370	30·556	2·546
	9	1·028	20·556	30·833	2·570
28	0	1·037	20·741	31·111	2·593
	3	1·046	20·926	31·389	2·616
	6	1·056	21·111	31·667	2·639
	9	1·065	21·296	31·944	2·662
29	0	1·074	21·481	32·222	2·685
	3	1·083	21·667	32·500	2·708
	6	1·093	21·852	32·778	2·731
	9	1·102	22·037	33·056	2·755
30	0	1·111	22·222	33·333	2·778
	3	1·120	22·407	33·611	2·801
	6	1·130	22·593	33·889	2·824
	9	1·139	22·778	34·167	2·847
31	0	1·148	22·963	34·444	2·870
	3	1·157	23·148	34·722	2·894
	6	1·167	23·333	35·000	2·917
	9	1·176	23·519	35·278	2·940
32	0	1·185	23·704	35·556	2·963
	3	1·194	23·889	35·833	2·986
	6	1·204	24·074	36·111	3·009
	9	1·213	24·259	36·389	3·033
33	0	1·222	24·444	36·667	3·056
	3	1·231	24·630	36·944	3·079
	6	1·241	24·815	37·222	3·102
	9	1·250	25·000	37·500	3·125
34	0	1·259	25·185	37·778	3·148
	3	1·268	25·370	38·056	3·171
	6	1·278	25·556	38·333	3·194
	9	1·287	25·741	38·611	3·218
35	0	1·296	25·926	38·889	3·241
	3	1·305	26·111	39·167	3·264
	6	1·315	26·296	39·444	3·287
	9	1·324	26·481	39·722	3·310
36	0	1·333	26·667	40·000	3·333
	3	1·342	26·852	40·278	3·357
	6	1·352	27·037	40·556	3·380
	9	1·361	27·222	40·833	3·403
37	0	1·370	27·407	41·111	3·426
	3	1·379	27·593	41·389	3·449
	6	1·389	27·778	41·667	3·472
	9	1·398	27·963	41·944	3·496
38	0	1·407	28·148	42·222	3·519
	3	1·416	28·333	42·500	3·542
	6	1·426	28·519	42·778	3·565
	9	1·435	28·704	43·056	3·588
39	0	1·444	28·889	43·333	3·611
	3	1·453	29·074	43·611	3·634
	6	1·463	29·259	43·889	3·657
	9	1·472	29·444	44·167	3·681
40	0	1·481	29·630	44·444	3·704
	3	1·490	29·815	44·722	3·727
	6	1·500	30·000	45·000	3·750
	9	1·509	30·185	45·278	3·773
41	0	1·519	30·370	45·556	3·796
	3	1·528	30·556	45·833	3·820
	6	1·537	30·741	46·111	3·843
	9	1·546	30·926	46·389	3·866
42	0	1·556	31·111	46·667	3.889
	3	1·565	31·296	46·944	3·912
	6	1·574	31·481	47·222	3·935
	9	1·583	31·667	47·500	3·958
43	0	1·593	31·852	47·778	3.981
	3	1·602	32·037	48·056	4·005
	6	1·611	32·222	48·333	4·028
	9	1·620	32·407	48·611	4·051
44	0	1·630	32·593	48·889	4·074
	3	1·639	32·778	49·167	4·097
	6	1·648	32·963	49·444	4·120
	9	1·657	33·148	49·722	4·144
45	0	1 667	33·333	50·000	4·167
	3	1·676	33·519	50·278	4·190
	6	1·685	33·704	50·556	4·213
	9	1·694	33·889	50·833	4·236
46	0	1·704	34·074	51·111	4·259
	3	1·713	34·259	51·389	4·283
	6	1·722	34·444	51·667	4·306
	9	1·731	34·630	51·944	4·329
47	0	1·741	34·815	52·222	4·352
	3	1·750	35·000	52·500	4·375
	6	1·759	35·185	52·778	4·398
	9	1·768	35·370	53·056	4·421
48	0	1·778	35·556	53·333	4·444
	3	1·787	35·741	53·611	4·468
	6	1·796	35·926	53·889	4·491
	9	1·805	36·111	54·167	4·514
49	0	1·815	36·296	54·444	4·537
	3	1·824	36·481	54·722	4·560
	6	1·833	36·667	55·000	4·583
	9	1·842	36·852	55·278	4·607
50	0	1·852	37·037	55·556	4·630

Table II. Continued—SLOPE 2¾ to 1.

Heights Ft.	In.	Base 1 Foot	Base 20 Feet	Base 30 Feet	Slopes
0	3	0.010	0·185	0·278	0·026
	6	0·019	0·370	0·556	0·051
	9	0·028	0·556	0·833	0·077
1	0	0·037	0·741	1·111	0·102
	3	0·046	0·926	1·389	0·128
	6	0·056	1·111	1·667	0·153
	9	0·065	1·296	1·944	0·179
2	0	0·074	1·481	2·222	0·204
	3	0·083	1·667	2·500	0·229
	6	0·093	1·852	2.778	0·254
	9	0·102	2·037	3·056	0·280
3	0	0·111	2·222	3·333	0·305
	3	0·120	2·407	3·611	0·331
	6	0·130	2·593	3·889	0·356
	9	0·139	2·778	4·167	0·382
4	0	0·148	2·963	4·444	0·407
	3	0·157	3·148	4·722	0·433
	6	0.167	3·333	5·000	0·458
	9	0·176	3.519	5·278	0·484
5	0	0·185	3·704	5·556	0·509
	3	0·194	3·889	5·833	0·535
	6	0·204	4·074	6·111	0·560
	9	0·213	4·259	6·389	0·586
6	0	0·222	4·444	6·667	0·611
	3	0·231	4·630	6·944	0·637
	6	0·241	4·815	7·222	0·663
	9	0·250	5.000	7·500	0·689
7	0	0·259	5·185	7·778	0·714
	3	0·268	5·370	8·056	0·739
	6	0·278	5·556	8·333	0·764
	9	0·287	5.741	8·611	0·790
8	0	0·296	5·926	8·889	0·815
	3	0·305	6·111	9·167	0·841
	6	0·315	6·296	9·444	0·866
	9	0·324	6·481	9·722	0·892
9	0	0·333	6·667	10·000	0·917
	3	0·342	6·852	10·278	0.943
	6	0·352	7·037	10·556	0·968
	9	0·361	7·222	10·833	0·994
10	0	0·370	7·407	11·111	1·019
	3	0·379	7·593	11·389	1·045
	6	0·389	7·778	11·667	1·070
	9	0·398	7·963	11·944	1·096
11	0	0·407	8·148	12·222	1·121
	3	0·416	8·333	12·500	1·147
	6	0·426	8·519	12·778	1·172
	9	0·435	8·704	13·056	1.197
12	0	0.444	8·889	13·333	1·222
	3	0·453	9·074	13·611	1·248
	6	0·463	9·259	13·889	1·273
	9	0·472	9·444	14·167	1·299
13	0	0·481	9·630	14·444	1·324
	3	0·490	9·815	14·722	1·350
	6	0·500	10·000	15.000	1·375
	9	0·509	10·185	15·278	1·401
14	0	0·519	10·370	15·556	1·426
	3	0·528	10·556	15·833	1·452
	6	0·537	10·741	16.111	1·477
	9	0·546	10·926	16·389	1·503
15	0	0·556	11·111	16·667	1·528
	3	0·565	11·296	16·944	1·554
	6	0·574	11·481	17·222	1·579
	9	0·583	11·667	17·500	1·605
16	0	0·593	11·852	17·778	1·630
	3	0·602	12·037	18·056	1·655
	6	0·611	12·222	18·333	1·680
	9	0·620	12·407	18·611	1·706
17	0	0·630	12·593	18·889	1·731
	3	0·639	12·778	19·167	1·757
	6	0·648	12·963	19·444	1·782
	9	0.657	13·148	19·722	1·808
18	0	0·667	13·333	20·000	1·833
	3	0.676	13·519	20·278	1·859
	6	0·685	13·704	20·556	1·884
	9	0·694	13·889	20·833	1·910
19	0	0·704	14·074	21·111	1·935
	3	0·713	14·259	21·389	1·961
	6	0·722	14·444	21·667	1·986
	9	0·731	14·630	21·944	2·012
20	0	0·741	14·815	22·222	2·038
	3	0·750	15·000	22·500	2·064
	6	0·759	15·185	22·778	2·089
	9	0·768	15·370	23·056	2·114
21	0	0·778	15·556	23·333	2·139
	3	0·787	15·741	23·611	2·165
	6	0·796	15·926	23·889	2·190
	9	0·805	16·111	24·167	2·216
22	0	0·815	16·296	24·444	2·241
	3	0·824	16·481	24·722	2·267
	6	0·833	16·667	25·000	2·292
	9	0·842	16·852	25·278	2·318
23	0	0·852	17·037	25·556	2·343
	3	0·861	17·222	25·833	2·369
	6	0·870	17·407	26·111	2·394
	9	0·879	17·593	26·389	2·420
24	0	0·889	17·778	26·667	2·445
	3	0·898	17·963	26·944	2·471
	6	0·907	18·148	27·222	2·496
	9	0·916	18·333	27·500	2·522
25	0	0·926	18·519	27·778	2·547
	3	0·935	18·704	28·056	2·572

Heights Ft.	In.	Base 1 Foot	Base 20 Feet	Base 30 Feet	Slopes
25	6	0·944	18·889	28·333	2·597
	9	0·953	19·074	28·611	2·623
26	0	0·963	19·259	28·889	2·648
	3	0·972	19·444	29·167	2·674
	6	0·981	19·630	29·444	2·699
	9	0·990	19·815	29·722	2·725
27	0	1·000	20·000	30·000	2·750
	3	1·009	20·185	30·278	2·776
	6	1·019	20·370	30·556	2·801
	9	1·028	20·556	30·833	2·827
28	0	1·037	20·741	31·111	2·852
	3	1·046	20·926	31·389	2·878
	6	1·056	21·111	31·667	2·903
	9	1·065	21·296	31·944	2·929
29	0	1·074	21·481	32·222	2·954
	3	1.083	21·667	32·500	2·980
	6	1·093	21·852	32·778	3·005
	9	1·102	22·037	33·056	3·030
30	0	1·111	22·222	33·333	3·055
	3	1·120	22·407	33·611	3·081
	6	1·130	22·593	33·889	3·106
	9	1·139	22.778	34·167	3·132
31	0	1·148	22·963	34·444	3·157
	3	1·157	23·148	34·722	3·183
	6	1·167	23·333	35·000	3·208
	9	1·176	23·519	35·278	3·234
32	0	1·185	23·704	35·556	3·259
	3	1·194	23·889	35·833	3·285
	6	1·204	24·074	36·111	3·310
	9	1·213	24·259	36·389	3·336
33	0	1·222	24·444	36·667	3·361
	3	1·231	24·630	36·944	3·387
	6	1·241	24·815	37·222	3·413
	9	1·250	25·000	37·500	3·439
34	0	1·259	25·185	37·778	3·464
	3	1·268	25·370	38·056	3·489
	6	1·278	25·556	38·333	3·514
	9	1·287	25·741	38·611	3·540
35	0	1·296	25·926	38·889	3·565
	3	1·305	26·111	39·167	3·591
	6	1·315	26·296	39·444	3·616
	9	1·324	26·481	39.722	3·642
36	0	1·333	26·667	40·000	3·667
	3	1·342	26·852	40·278	3·693
	6	1·352	27·037	40·556	3·718
	9	1·361	27·222	40·833	3·744
37	0	1·370	27·407	41·111	3·769
	3	1·379	27·593	41·389	3·795
	6	1·389	27·778	41·667	3·820
	9	1·398	27·963	41·944	3·845
38	0	1·407	28·148	42·222	3·871
	3	1·416	28·333	42·500	3·897
	6	1·426	28·519	42·778	3·922
	9	1·435	28·704	43·056	3·947
39	0	1·444	28·889	43·333	3·972
	3	1·453	29·074	43·611	3·998
	6	1·463	29·259	43·889	4·023
	9	1·472	29·444	44·167	4·049
40	0	1·481	29·630	44.444	4·074
	3	1·490	29·815	44·722	4·100
	6	1.500	30·000	45·000	4·125
	9	1·509	30·185	45·278	4·151
41	0	1·519	30·370	45·556	4·176
	3	1·528	30·556	45·833	4·202
	6	1·537	30·741	46·111	4·227
	9	1·546	30·926	46·389	4·253
42	0	1·556	31·111	46·667	4·278
	3	1·565	31·296	46·944	4·304
	6	1·574	31·481	47·222	4·329
	9	1·583	31·667	47·500	4·355
43	0	1·593	31·852	47·778	4·380
	3	1·602	32·037	48·056	4·405
	6	1·611	32·222	48·333	4·430
	9	1·620	32·407	48·611	4·456
44	0	1·630	32·593	48·889	4·481
	3	1·639	32·778	49·167	4.507
	6	1·648	32·963	49·444	4·532
	9	1·657	33·148	49·722	4·558
45	0	1·667	33·333	50·000	4·583
	3	1·676	33·519	50·278	4·609
	6	1·685	33·704	50·556	4·634
	9	1·694	33·889	50·833	4·660
46	0	1·704	34·074	51·111	4·685
	3	1·713	34·259	51·389	4·711
	6	1·722	34·444	51·667	4·736
	9	1·731	34·630	51.944	4·762
47	0	1·741	34·815	52·222	4·788
	3	1·750	35·000	52·500	4·814
	6	1·759	35·185	52·778	4·839
	9	1·768	35·370	53·056	4·864
48	0	1·778	35·556	53·333	4·889
	3	1·787	35·741	53·611	4·915
	6	1·796	35·926	53·889	4·940
	9	1·805	36·111	54·167	4·966
49	0	1·815	36·296	54·444	4·991
	3	1·824	36·481	54·722	5·017
	6	1·833	36·667	55·000	5·042
	9	1·842	36·852	55·278	5·068
50	0	1·852	37·037	55·556	5·093

Heights Ft.	In.	Base 1 Foot	Base 20 Feet	Base 30 Feet	Slopes
0	3	0·010	0·185	0·278	0·028
	6	0·019	0·370	0·556	0·056
	9	0·028	0·556	0·833	0·083
1	0	0·037	0·741	1·111	0·111
	3	0·046	0·926	1·389	0·139
	6	0·056	1·111	1·667	0·167
	9	0·065	1·296	1·944	0·194
2	0	0·074	1·481	2·222	0·222
	3	0·083	1·667	2·500	0·250
	6	0·093	1·852	2·778	0·278
	9	0·102	2·037	3·056	0·305
3	0	0·111	2·222	3·333	0·333
	3	0·120	2·407	3·611	0·361
	6	0·130	2·593	3·889	0·389
	9	0·139	2·778	4·167	0·416
4	0	0·148	2·963	4·444	0·444
	3	0·157	3·148	4·722	0·472
	6	0·167	3·333	5·000	0·500
	9	0·176	3·519	5·278	0·528
5	0	0·185	3·704	5·556	0·556
	3	0·194	3·889	5·833	0·583
	6	0·204	4·074	6.111	0·611
	9	0·213	4·259	6·389	0·639
6	0	0·222	4·444	6·667	0·667
	3	0·231	4.630	6·944	0·694
	6	0·241	4·815	7·222	0·722
	9	0·250	5·000	7·500	0·750
7	0	0·259	5·185	7·778	0·778
	3	0·268	5·370	8·056	0·805
	6	0·278	5·556	8·333	0·833
	9	0·287	5·741	8·611	0·861
8	0	0·296	5·926	8·889	0·889
	3	0·305	6·111	9·167	0·916
	6	0·315	6·296	9·444	0·944
	9	0·324	6·481	9·722	0·972
9	0	0·333	6·667	10·000	1·000
	3	0·342	6·852	10·278	1·028
	6	0·352	7·037	10·556	1·056
	9	0·361	7·222	10·833	1·083
10	0	0·370	7·407	11·111	1·111
	3	0·379	7·593	11·389	1·139
	6	0·389	7·778	11·667	1·167
	9	0·398	7·963	11·944	1·194
11	0	0·407	8·148	12·222	1·222
	3	0·416	8·333	12·500	1·250
	6	0·426	8·519	12·778	1·278
	9	0·435	8·704	13·056	1·305
12	0	0·444	8·889	13·333	1·333
	3	0·453	9·074	13·611	1·361
	6	0·463	9·259	13·889	1·389
	9	0·472	9·444	14·167	1·416
13	0	0·481	9·630	14·444	1·444
	3	0·490	9·815	14·722	1·472
	6	0·500	10·000	15·000	1·500
	9	0·509	10·185	15·278	1·528
14	0	0·519	10·370	15·556	1·556
	3	0.528	10·556	15·833	1·583
	6	0·537	10·741	16·111	1·611
	9	0·546	10·926	16·389	1·639
15	0	0·556	11·111	16·667	1·667
	3	0·565	11·296	16·944	1·694
	6	0·574	11·481	17·222	1·722
	9	0·583	11·667	17·500	1·750
16	0	0·593	11·852	17·778	1·778
	3	0·602	12·037	18·056	1·805
	6	0·611	12·222	18·333	1·833
	9	0·620	12·407	18·611	1·861
17	0	0·630	12·593	18·889	1·889
	3	0·639	12·778	19·167	1·916
	6	0·648	12·963	19·444	1·944
	9	0.657	13.148	19·722	1·972
18	0	0·667	13.333	20·000	2·000
	3	0·676	13·519	20·278	2·028
	6	0·685	13·704	20·556	2·056
	9	0·694	13·889	20·833	2·083
19	0	0·704	14·074	21·111	2·111
	3	0·713	14·259	21·389	2·139
	6	0·722	14·444	21·667	2·167
	9	0·731	14·630	21·944	2·194
20	0	0·741	14·815	22·222	2·222
	3	0.750	15·000	22·500	2.250
	6	0·759	15·185	22·778	2·278
	9	0·768	15·370	23.056	2·305
21	0	0.778	15.556	23·333	2.333
	3	0·787	15.741	23·611	2·361
	6	0·796	15·926	23·889	2·389
	9	0·805	16·111	24·167	2·416
22	0	0·815	16·296	24·444	2·444
	3	0·824	16·481	24·722	2·472
	6	0·833	16·667	25·000	2·500
	9	0·842	16·852	25·278	2·528
23	0	0·852	17·037	25·556	2·556
	3	0·861	17·222	25·833	2·583
	6	0·870	17·407	26·111	2·611
	9	0·879	17·593	26·389	2·639
24	0	0·889	17·778	26·667	2·667
	3	0·898	17·963	26·944	2·694
	6	0·907	18·148	27·222	2 722
	9	0·916	18·333	27·500	2·750
25	0	0·926	18·519	27·778	2·778
	3	0·935	18·704	28·056	2·805

Heights Ft. In	Base 1 Foot	Base 20 Feet	Base 30 Feet	Slopes
25 6	0.944	18·889	28·333	2·833
9	0·953	19·074	28·611	2·861
26 0	0·963	19·259	28·889	2·889
3	0·972	19·444	29·167	2·916
6	0·981	19·630	29·444	2·944
9	0·990	19·815	29·722	2·972
27 0	1·000	20·000	30·000	3·000
3	1·009	20·185	30·278	3·028
6	1·019	20·370	30·556	3·056
9	1·028	20·556	30·833	3·083
28 0	1·037	20·741	31·111	3·111
3	1·046	20·926	31·389	3·139
6	1·056	21·111	31·667	3·167
9	1·065	21·296	31·944	3·194
29 0	1·074	21·481	32·222	3·222
3	1·083	21·667	32·500	3·250
6	1·093	21·852	32·778	3·278
9	1·102	22·037	33·056	3·305
30 0	1·111	22·222	33·333	3·333
3	1·120	22·407	33·611	3·361
6	1·130	22·593	33·889	3·389
9	1·139	22·778	34·167	3·416
31 0	1·148	22·963	34·444	3·444
3	1·157	23·148	34·722	3·472
6	1·167	23·333	35·000	3·500
9	1·176	23·519	35·278	3·528
32 0	1·185	23·704	35·556	3·556
3	1·194	23·889	35·833	3·583
6	1·204	24·074	36·111	3·611
9	1·213	24·259	36·389	3·639
33 0	1·222	24·444	36·667	3·667
3	1·231	24·630	36·944	3·694
6	1·241	24·815	37·222	3·722
9	1·250	25·000	37·500	3·750
34 0	1·259	25·185	37·778	3·778
3	1·268	25·370	38·056	3.805
6	1·278	25·556	38·333	3·833
9	1·287	25·741	38·611	3·861
35 0	1·296	25·926	38·889	3·889
3	1·305	26·111	39·167	3·916
6	1·315	26·296	39·444	3.944
9	1·324	26·481	39·722	3·972
36 0	1·333	26·667	40·000	4·000
3	1·342	26·852	40·278	4·028
6	1·352	27·037	40·556	4·056
9	1·361	27·222	40·833	4·083
37 0	1·370	27·407	41·111	4·111
3	1·379	27·593	41·389	4·139
6	1·389	27·778	41·667	4·167
9	1·398	27·963	41·944	4·194
38 0	1·407	28·148	42·222	4·222
3	1·416	28·333	42·500	4·250
6	1·426	28·519	42·778	4·278
9	1·435	28·704	43·056	4·306
39 0	1·444	28·889	43·333	4·333
3	1·453	29·074	43·611	4·361
6	1·463	29·259	43·889	4·389
9	1·472	29·444	44·167	4·416
40 0	1·481	29·630	44·444	4·444
3	1·490	29·815	44·722	4·472
6	1·500	30·000	45·000	4·500
9	1·509	30·185	45·278	4·528
41 0	1·519	30·370	45·556	4·556
3	1·528	30·556	45·833	4·583
6	1·537	30·741	46·111	4·611
9	1·546	30·926	46·389	4·639
42 0	1·556	31·111	46·667	4·667
3	1·565	31·296	46·944	4·694
6	1·574	31·481	47·222	4·722
9	1·583	31·667	47·500	4·750
43 0	1·593	31·852	47·778	4·778
3	1·602	32·037	48·056	4·806
6	1·611	32·222	48·333	4·833
9	1·620	32·407	48·611	4·861
44 0	1·630	32·593	48·889	4·889
3	1·639	32·778	49·167	4·917
6	1·648	32·963	49·444	4·944
9	1·657	33·148	49·722	4·972
45 0	1·667	33 333	50·000	5·000
3	1·676	33·519	50·278	5·028
6	1·685	33·704	50·556	5·056
9	1·694	33·889	50·833	5·083
46 0	1·704	34·074	51·111	5·111
3	1·713	34·259	51·389	5·139
6	1·722	34·444	51·667	5·167
9	1·731	34·630	51·944	5·194
47 0	1·741	34·815	52·222	5.222
3	1·750	35·000	52·500	5.250
6	1·759	35·185	52·778	5·278
9	1·768	35·370	53·056	5·306
48 0	1·778	35·556	53·333	5·333
3	1·787	35·741	53·611	5·361
6	1·796	35·926	53·889	5·389
9	1·805	36·111	54·167	5·417
49 0	1·815	36·296	54·444	5·444
3	1·824	36·481	54·722	5·472
6	1·833	36·667	55·000	5·500
9	1·842	36·852	55·278	5·528
50 0	1·852	37·037	55·556	5·556

TABLE III. For Bases from 1 to 10 Feet, without Slopes.

Average Height	Base 1 Foot	Base 2 Feet	Base 3 Feet	Base 4 Feet	Base 5 Feet	Base 6 Feet	Base 7 Feet	Base 8 Feet	Base 9 Feet	Base 10 Feet
0 3	0·009	0·019	0·028	0·037	0·046	0·056	0·065	0·074	0.083	0·093
6	0·019	0·037	0.056	0·074	0·093	0·111	0·130	0·148	0·167	0·185
9	0·028	0·056	0·083	0·111	0·139	0·167	0·194	0·222	0·250	0·278
1 0	0·037	0·074	0·111	0·148	0·185	0·222	0·259	0·296	0·333	0·370
3	0·046	0·093	0·139	0·185	0·231	0·278	0·324	0·370	0·417	0·463
6	0·056	0·111	0·167	0·222	0·278	0·333	0·389	0·444	0·500	0·556
9	0·065	0·130	0·194	0·259	0·324	0·389	0·454	0·519	0·583	0·648
2 0	0·074	0·148	0·222	0·296	0·370	0·444	0·519	0·593	0·667	0·741
3	0·083	0·167	0·250	0·333	0·416	0·500	0·583	0·667	0·750	0·833
6	0·093	0·185	0·278	0·370	0·463	0·556	0·648	0·741	0·833	0·926
9	0·102	0·204	0·306	0·407	0·509	0·611	0·713	0·815	0·917	1·019
3 0	0·111	0·222	0.333	0·444	0·556	0·667	0·778	0·889	1·000	1·111
3	0·120	0·241	0·361	0·481	0·602	0·722	0·843	0·963	1·083	1·204
6	0·130	0·259	0·389	0.519	0·648	0·778	0·907	1·037	1·167	1·296
9	0.139	0·278	0·417	0·556	0·694	0·833	0·972	1·111	1·250	1·389
4 0	0·148	0·296	0·444	0·593	0·741	0·889	1·037	1·185	1·333	1·481
3	0·157	0·315	0·472	0·630	0·787	0·944	1·102	1·259	1·417	1·574
6	0·167	0·333	0·500	0·667	0·833	1·000	1·167	1·333	1·500	1·667
9	0·176	0·352	0·528	0·704	0·879	1·056	1·231	1·407	1·583	1·759
5 0	0·185	0·370	0·556	0·741	0·926	1·111	1·296	1·481	1·667	1·852
3	0·194	0.389	6·583	0·778	0·972	1·167	1·361	1·556	1·750	1·944
6	0·204	0·407	0·611	0·815	1·019	1·222	1·426	1·630	1·833	2·037
9	0·213	0·426	0·639	0·852	1·065	1·278	1·491	1·704	1·917	2·130
6 0	0·222	0·444	0·667	0·889	1·111	1·333	1·556	1·778	2·000	2·222
3	0·231	0·463	0·694	0·926	1·157	1·389	1·620	1·852	2·083	2·315
6	0·241	0·481	0·722	0·963	1·204	1·444	1·685	1·926	2·167	2·407
9	0·250	0·500	0·750	1·000	1·250	1·500	1·750	2·000	2·250	2·500
7 0	0·259	0·519	0·778	1·037	1·296	1·556	1·815	2·074	2·333	2·593
3	0·268	0·537	0·806	1·074	1·342	1·611	1·880	2·148	2·417	2·685
6	0·278	0·556	0·833	1·111	1·389	1·667	1·944	2·222	2·500	2·778
9	0·287	0·574	0·861	1·148	1·435	1·722	2·009	2·296	2·583	2.870
8 0	0·296	0·593	0·889	1·185	1·481	1·778	2·074	2·370	2·667	2·963
3	0·305	0·611	0·917	1·222	1·527	1·833	2·139	2·444	2·750	3·056
6	0·315	0·630	0·944	1·259	1·574	1·889	2·204	2·519	2·833	3·148
9	0·324	0·648	0·972	1·296	1·620	1·944	2·269	2·593	2·917	3·241
9 0	0·333	0·667	1·000	1·333	1·667	2·000	2·333	2·667	3·000	3·333
3	0·342	0·685	1·028	1·370	1·713	2·056	2·398	2·741	3·083	3·426
6	0·352	0·704	1·056	1·407	1·759	2·111	2·463	2·815	3·167	3·519
9	0·361	0·722	1·083	1·444	1·805	2·167	2·528	2·889	3·250	3·611
10 0	0·370	0·741	1·111	1·481	1·852	2·222	2·593	2·963	3·333	3·704
3	0·380	0·759	1·139	1·519	1·898	2·278	2·657	3·037	3·417	3·796
6	0·389	0·778	1·167	1·556	1·944	2·333	2·722	3·111	3·500	3·889
9	0·398	0·796	1·194	1·593	1·990	2·389	2·787	3·185	3·583	3·981
11 0	0·407	0·815	1·222	1·630	2·037	2·444	2·852	3·259	3·667	4·074
3	0·417	0·833	1·250	1·667	2·083	2·500	2·917	3·333	3·750	4·167
6	0·426	0·852	1·278	1·704	2·130	2·556	2·981	3.407	3·833	4·259
9	0·435	0·870	1·306	1·741	2·176	2·611	3·046	3·481	3·917	4·352
12 0	0·444	0·889	1·333	1·778	2·222	2·667	3·111	3·556	4·000	4·444
3	0·453	0·907	1·361	1·815	2·268	2·722	3·176	3·630	4·083	4·537
6	0·463	0·926	1·389	1·852	2·315	2·778	3·241	3·704	4·167	4·630
9	0·472	0·944	1·417	1·889	2·361	2·833	3·305	3·778	4·250	4·722

Average Height	Base 1 Foot	Base 2 Feet	Base 3 Feet	Base 4 Feet	Base 5 Feet	Base 6 Feet	Base 7 Feet	Base 8 Feet	Base 9 Feet	Base 10 Feet
Ft. In										
13 0	0·481	0·963	1·444	1·926	2·407	2·889	3·370	3·852	4·333	4·815
3	0·491	0·981	1·472	1·963	2·454	2·944	3·435	3·926	4·417	4·907
6	0·500	1·000	1·500	2·000	2·500	3·000	3·500	4·000	4·500	5·000
9	0·509	1·019	1·528	2·037	2·546	3·056	3·565	4·074	4·583	5·093
14 0	0·519	1·037	1·556	2·074	2·593	3·111	3·630	4·148	4·667	5·185
3	9·528	1.056	1·583	2·111	2·639	3·167	3·694	4·222	4·750	5·278
6	0·537	1·074	1·611	2·148	2·685	3·222	3·759	4·296	4·833	5·370
9	0·546	1·093	1·639	2·185	2·731	3·278	3·824	4·370	4·917	5·463
15·0	0·556	1·111	1·667	2·222	2·778	3·333	3·889	4·444	5·000	5·556
3	0·565	1·130	1·694	2·259	2·824	3·389	3·954	4·519	5·083	5·648
6	0·574	1·148	1·722	2·296	2·870	3·444	4·019	4·593	5·167	5·741
9	0·583	1·167	1·750	2·333	2·916	3·500	4·083	4·667	5·250	5·833
16 0	0·593	1·185	1·778	2·370	2·963	3·556	4·148	4·741	5·333	5·926
3	0·602	1·204	1·806	2·407	3·009	3·611	4·213	4·815	5·417	6·019
6	0·611	1·222	1·833	2·444	3·056	3·667	4·278	4·889	5·500	6·111
9	0·620	1·241	1·861	2·481	3·102	3·722	4·343	4·963	5·583	6·204
17 0	0·630	1·259	1·889	2·519	3·148	3·778	4·407	5·037	5·667	6·296
3	0·639	1·278	1·917	2·556	3·194	3·833	4·472	5·111	5·750	6·389
6	0·648	1·296	1·944	2·593	3·241	3·889	4·537	5·185	5·833	6·481
9	0·657	1·315	1·972	2·630	3·287	3·944	4·602	5·259	5·917	6·574
18 0	0·667	1·333	2·000	2·667	3·333	4·000	4·667	5·333	6·000	6·667
3	0·676	1·352	2·028	2·704	3·379	4·056	4·731	5·407	6·083	6·759
6	0·685	1·370	2·056	2·741	3·426	4·111	4·796	5·481	6·167	6·852
9	0·694	1·389	2·083	2·778	3·472	4·167	4·861	5·556	6·250	6·944
19 0	0·704	1·407	2·111	2·815	3·519	4·222	4·926	5·630	6·333	7·037
3	0·713	1·426	2·139	2·852	3·565	4·278	4·991	5·704	6·417	7·130
6	0·722	1·444	2·167	2·889	3·611	4·333	5·056	5·778	6·500	7·222
9	0·731	1·463	2·194	2·926	3·657	4·389	5·120	5·852	6·583	7·315
20 0	0·741	1·481	2·222	2·963	3·704	4·444	5·185	5·926	6·667	7·407
3	0·750	1·500	2·250	3·000	3·750	4·500	5·250	6·000	6·750	7·500
6	0·759	1·519	2·278	3·037	3·796	4·556	5·315	6·074	6·833	7·593
9	0·768	1·537	2·306	3·074	3·842	4·611	5·380	6·148	6·917	7·685
21 0	0·778	1·556	2·333	3·111	3·889	4·667	5·444	6·222	7·000	7·778
3	0·787	1·574	2·361	3·148	3·935	4·722	5·509	6·296	7·083	7·870
6	0·796	1·593	2·389	3·185	3·981	4·778	5·574	6·370	7·167	7·963
9	0·805	1·611	2·417	3·222	4·027	4·833	5·639	6·444	7·250	8·056
22 0	0·815	1·630	2·444	3·259	4·074	4·889	5·704	6·519	7·333	8·148
3	0·824	1·648	2·472	3·296	4·120	4·944	5·769	6·593	7·417	8·241
6	0·833	1·667	2·500	3·333	4·167	5·000	5·833	6·667	7·500	8·333
9	0·842	1·685	2·528	3·370	4·213	5·056	5·898	6·741	7·583	8·426
23 0	0·852	1·704	2·556	3·407	4·259	5·111	5·963	6·815	7·667	8·519
3	0·861	1·722	2·583	3·444	4·305	5·167	6·028	6·889	7·750	8·611
6	0·870	1·741	2·611	3·481	4·352	5·222	6·093	6·963	7·833	8·704
9	0·880	1·759	2·639	3·519	4·398	5·278	6·157	7·037	7·917	8·796
24 0	0·889	1·778	2·667	3·556	4·444	5·333	6·222	7·111	8·000	8·889
3	0·898	1·796	2·694	3·593	4·490	5·389	6·287	7·185	8·083	8·981
6	0·907	1·815	2·722	3·630	4·537	5·444	6·352	7·259	8·167	9·074
9	0·917	1·833	2·750	3·667	4·583	5·500	6·417	7·333	8·250	9·167
25 0	0·926	1·852	2·778	3·704	4·630	5·556	6·481	7·407	8·333	9·259
3	0·935	1·870	2·806	3·741	4·676	5·611	6·546	7·481	8·417	9·352

Average Height	Base 1 Foot	Base 2 Feet	Base 3 Feet	Base 4 Feet	Base 5 Feet	Base 6 Feet	Base 7 Feet	Base 8 Feet	Base 9 Feet	Base 10 Feet
Ft. In										
25 6	0·944	1·889	2·833	3·778	4·722	5·667	6·611	7·556	8·500	9·444
9	0·953	1·907	2·861	3·815	4·768	5·722	6·676	7·630	8·583	9·537
26 0	0·963	1·926	2·889	3·852	4·815	5·778	6·741	7·704	8·667	9·630
3	0·972	1·944	2·917	3.889	4·861	5·833	6·805	7·778	8·750	9·722
6	0·981	1·963	2·944	3·926	4·907	5·889	6·870	7·852	8·833	9·815
9	0·991	1·981	2·972	3·963	4·954	5·944	6·935	7·926	8·917	9·907
27 0	1·000	2·000	3·000	4·000	5·000	6·000	7·000	8·000	9·000	10·000
3	1·009	2·019	3·028	4·037	5·046	6·056	7·065	8·074	9·083	10·093
6	1·019	2·037	3·056	4·074	5·093	6·111	7·130	8·148	9·167	10·185
9	1.028	2·056	3·083	4·111	5·139	6·167	7·194	8·222	9·250	10·278
28 0	1·037	2·074	3·111	4·148	5·185	6·222	7·259	8·296	9·333	10·370
3	1·046	2·093	3·139	4·185	5·231	6·278	7·324	8·370	9·417	10·463
6	1·056	2·111	3·167	4·222	5·278	6·333	7·389	8·444	9·500	10·556
9	1·065	2·130	3·194	4·259	5·324	6·389	7·454	8·519	9·583	10·648
29 0	1·074	2·148	3·222	4·296	5·370	6·444	7·519	8·596	9·667	10·741
3	1·083	2·167	3·250	4·333	5·416	6·500	7·583	8·667	9·750	10·833
6	1·093	2·185	3·278	4·370	5·463	6·556	7·648	8·741	9·833	10·926
9	1·102	2·204	3·306	4·407	5·509	6·611	7·713	8·815	9·917	11·019
30 0	1·111	2·222	3.333	4·444	5·556	6·667	7.778	8·889	10·000	11·111
3	1·120	2·241	3·361	4·481	5·602	6·722	7·843	8·963	10·083	11·204
6	1·130	2·259	3·389	4·519	5·648	6·778	7·907	9·037	10·167	11·296
9	1·139	2·278	3·417	4·556	5·694	6.833	7.972	9·111	10·250	11·389
31 0	1·148	2·296	3.444	4.593	5·741	6·889	8·037	9·185	10·333	11·481
3	1·157	2·315	3·472	4·630	5·787	6·944	8·102	9·259	10·417	11·574
6	1·167	2·333	3·500	4·667	5·833	7·000	8·167	9·333	10·500	11·667
9	1·176	2·352	3·528	4·704	5·879	7·056	8·231	9·407	10·583	11·759
32 0	1·185	2·370	3·556	4·741	5·926	7·111	8·296	9·481	10·667	11·852
3	1·194	2·389	3·583	4·778	5·972	7·167	8·361	9·556	10·750	11·944
6	1·204	2·407	3·611	4·815	6·019	7·222	8·426	9·630	10·833	12·037
9	1·213	2·426	3.639	4·852	6·065	7·278	8·491	9·704	10·917	12·130
33 0	1·222	2·444	3·667	4·889	6·111	7·333	8·556	9·778	11·000	12·222
3	1·231	2·463	3·694	4·926	6·157	7·389	8·620	9·852	11·083	12·315
6	1·241	2·481	3·722	4·963	6·204	7·444	8·685	9·926	11·167	12·407
9	1·250	2·500	3·750	5·000	6·250	7·500	8·750	10·000	11·250	12·500
34 0	1·259	2·519	3·778	5·037	6·296	7·556	8·815	10·074	11·333	12·593
3	1·268	2·537	3·806	5·074	6·342	7·611	8·880	10·148	11·417	12·685
6	1·278	2·556	3·833	5·111	6·389	7·667	8·944	10·222	11·500	12·778
9	1·287	2·574	3·861	5·148	6·435	7·722	9·009	10·296	11·583	12·870
35 0	1·296	2·593	3·889	5·185	6·481	7·778	9·074	10·370	11·667	12·963
3	1·305	2·611	3·917	5·222	6·527	7·833	9·139	10·444	11·750	13·056
6	1·315	2·630	3·944	5·259	6·574	7·889	9·204	10·519	11·833	13·148
9	1·324	2·648	3·972	5·296	6·620	7·944	9·269	10·593	11·917	13·241
36 0	1·333	2·667	4·000	5·333	6·667	8·000	9·333	10·667	12·000	13·333
3	1·342	2·685	4·028	5·370	6·713	8·056	9·398	10·741	12·083	13·426
6	1·352	2·704	4·056	5·407	6·759	8·111	9·463	10·815	12·167	13·519
9	1·361	2·722	4·083	5·444	6·805	8·167	9·528	10·889	12·250	13·611
37 0	1·370	2·741	4·111	5·481	6·852	8·222	9·593	10·963	12·333	13·704
3	1·380	2·759	4·139	5·519	6·898	8·278	9·657	11·037	12·417	13·796
6	1·389	2·778	4·167	5·556	6·944	8·332	9·722	11·111	12·500	13·889
9	1·398	2·796	4·194	5·593	6·990	8·389	9·787	11·185	12·583	13·981

Average Height Ft.	In.	Base 1 Foot	Base 2 Feet	Base 3 Feet	Base 4 Feet	Base 5 Feet	Base 6 Feet	Base 7 Feet	Base 8 Feet	Base 9 Feet	Base 10 Feet
38	0	1·407	2·815	4·222	5·630	7·037	8·444	9·852	11·259	12·667	14·074
	3	1·417	2·833	4·250	5·667	7·083	8·500	9·917	11·333	12·750	14·167
	6	1·426	2·852	4·278	5·704	7·130	8·556	9·981	11·407	12·833	14·259
	9	1·435	2·870	4·306	5·741	7·176	8·611	10·046	11·481	12·917	14·352
39	0	1·444	2·889	4·333	5·778	7·222	8·667	10·111	11·556	13·000	14·444
	3	1·453	2·907	4·361	5·815	7·268	8·722	10·176	11·630	13·083	14·537
	6	1·463	2·926	4·389	5·852	7·315	8·778	10·241	11·704	13·167	14·630
	9	1·472	2·944	4·417	5·889	7·361	8·833	10·305	11·778	13·250	14·722
40	0	1·481	2·963	4·444	5·926	7·407	8·889	10·370	11·852	13·333	14·815
	3	1·491	2·981	4·472	5·963	7·454	8·944	10·435	11·926	13·417	14·907
	6	1·500	3·000	4·500	6·000	7·500	9·000	10·500	12·000	13·500	15·000
	9	1·509	3·019	4·528	6·037	7·546	9·056	10·565	12·074	13·583	15·093
41	0	1·519	3·037	4·556	6·074	7·593	9·111	10·630	12·148	13·667	15·185
	3	1·528	3·056	4·583	6.111	7·639	9·167	10·694	12·222	13·750	15·278
	6	1·537	3·074	4·611	6·148	7·685	9·222	10·759	12·296	13·833	15·370
	9	1·546	3·093	4·639	6·185	7·731	9·278	10·824	12·370	13·917	15·463
42	0	1·556	3·111	4·667	6·222	7·778	9·333	10·889	12·444	14·000	15·556
	3	1·565	3·130	4·694	6·259	7·824	9·389	10·954	12·519	14·083	15·648
	6	1.574	3·148	4·722	6·296	7·870	9·444	11·019	12·593	14·167	15·741
	9	1·583	3·167	4·750	6·333	7·916	9·500	11·083	12·667	14·250	15·833
43	0	1·593	3·185	4·778	6·370	7·963	9·556	11·148	12·741	14·333	15·926
	3	1·602	3·204	4·806	6·407	8·009	9·611	11·213	12·815	14·417	16·019
	6	1·611	3·222	4·833	6·444	8·056	9·667	11·278	12·889	14·500	16·111
	9	1·620	3·241	4·861	6·481	8·102	9·722	11·343	12·963	14·583	16·204
44	0	1·630	3·259	4·889	6·519	8·148	9·778	11·407	13·037	14·667	16·296
	3	1·639	3·278	4·917	6·556	8·194	9·833	11·472	13·111	14·750	16·389
	6	1·648	3·296	4·944	6·593	8·241	9·889	11·537	13·185	14·833	16·481
	9	1·657	3·315	4·972	6·630	8·287	9·944	11·602	13·259	14·917	16·574
45	0	1·667	3·333	5·000	6·667	8·333	10·000	11·667	13·333	15·000	16·667
	3	1·676	3·352	5·028	6·704	8·379	10·056	11·731	13·407	15·083	16·759
	6	1·685	3·370	5·056	6·741	8·426	10·111	11·796	13·481	15·167	16·852
	9	1·694	3·389	5·083	6·778	8·472	10·167	11·861	13·556	15·250	16·944
46	0	1·704	3·407	5·111	6·815	8·519	10·222	11·926	13·630	15·333	17·037
	3	1·713	3·426	5·139	6·852	8·565	10·278	11·991	13·704	15·417	17·130
	6	1·722	3·444	5·167	6·889	8·611	10·333	12·056	13·778	15·500	17·222
	9	1·731	3·463	5·194	6·926	8·657	10·389	12·120	13·852	15·583	17·315
47	0	1·741	3·481	5·222	6·963	8·704	10·444	12·185	13·926	15·667	17·407
	3	1·750	3·500	5·250	7·000	8·750	10·500	12·250	14·000	15·750	17·500
	6	1·759	3·519	5·278	7·037	8·796	10·556	12·315	14·074	15·833	17·593
	9	1·768	3·537	5·306	7·074	8·842	10·611	12·380	14·148	15·917	17·685
48	0	1·778	3·556	5·333	7·111	8·889	10·667	12·444	14·222	16·000	17·778
	3	1·787	3·574	5·361	7·148	8·935	10·722	12·509	14·296	16·083	17·870
	6	1·796	3·593	5·389	7·185	8·981	10·778	12·574	14·370	16·167	17·963
	9	1·805	3·611	5·417	7·222	9·027	10·833	12·639	14·444	16·250	18·056
49	0	1·815	3·630	5·444	7·259	9·074	10·889	12·704	14·519	16·333	18·148
	3	1·824	3·648	5·472	7·296	9·120	10·994	12·769	14·593	16·417	18·241
	6	1·833	3·667	5·500	7·333	9·167	11·000	12·833	14·667	16·500	18·333
	9	1·842	3·685	5·528	7·370	9·213	11·056	12·898	14·741	16·583	18·426
50	0	1·852	3·704	5·556	7·407	9·259	11·111	12·963	14·815	16·667	18·519

TABLE IV. Base 30 Feet, Side Slopes 1 to 1.

Mean height	Cubic yards per lineal foot in level ground	TRANSVERSE SLOPES OF GROUND.											
		One in 30	One in 20	One in 16	One in 14	One in 12	One in 11	One in 10	One in 9	One in 8	One in 7	One in 6	One in 5
ft. in													
0 6	0·58	0·01	—	—	—	—	—	—	—	—	—	—	—
1 0	1·15	0·01	0·02	0·04	—	—	—	—	—	—	—	—	—
6	1·76	0·01	0·03	0·04	0·05	0·07	0·08	0·10	—	—	—	—	—
2 0	2·37	0·01	0·03	0·04	0·05	0·07	0·09	0·11	0·13	0·17	—	—	—
6	3·02	0·01	0·03	0·04	0·06	0·07	0·09	0·11	0·14	0·18	0·24	0·32	—
3 0	3·67	0·01	0·03	0·05	0·06	0·08	0·10	0·12	0·15	0·19	0·25	0·34	0·50
6	4·36	0·01	0·03	0·05	0·06	0·08	0·10	0·13	0·16	0·20	0·26	0·36	0·53
4 0	5·04	0·01	0·03	0·05	0·07	0·09	0·11	0·13	0·17	0·21	0·28	0·38	0·56
6	5·76	0·01	0·04	0·06	0·07	0·09	0·12	0·14	0·18	0·22	0·29	0·40	0·59
5 0	6·48	0·02	0·04	0·06	0·08	0·10	0·12	0·15	0·19	0·24	0·31	0·42	0·62
6	7·24	0·02	0·04	0·06	0·08	0·10	0·13	0·16	0·19	0·25	0·32	0·44	0·65
6 0	8·00	0·02	0·04	0·06	0·08	0·11	0·14	0·16	0·20	0·26	0·34	0·47	0·68
6	8·80	0·02	0·04	0·07	0·09	0·11	0·14	0·17	0·21	0·27	0·36	0·49	0·71
7 0	9·59	0·02	0·04	0·07	0·09	0·12	0·15	0·18	0·22	0·28	0·37	0·51	0·75
6	10·42	0·02	0·05	0·07	0·10	0·13	0·16	0·19	0·23	0·30	0·39	0·53	0·78
8 0	11·26	0·02	0·05	0·08	0·10	0·14	0·16	0·20	0·24	0·31	0·41	0·56	0·82
6	12·13	0·02	0·05	0·08	0·10	0·14	0·17	0·21	0·26	0·32	0·43	0·58	0·85
9 0	13·00	0·02	0·05	0·08	0·11	0·15	0·18	0·21	0·27	0·34	0·44	0·61	0·89
6	13·90	0·02	0·06	0·09	0·11	0·16	0·18	0·22	0·28	0·35	0·46	0·63	0·93
10 0	14·81	0·03	0·06	0·09	0·12	0·16	0·19	0·23	0·29	0·37	0·48	0·66	0·96
6	15·75	0·03	0·06	0·09	0·12	0·17	0·20	0·24	0·30	0·38	0·50	0·69	1·00
11 0	16·70	0·03	0·06	0·10	0·13	0·17	0·21	0·25	0·31	0·40	0·52	0·71	1·04
6	17·68	0·03	0·06	0·10	0·13	0·18	0·22	0·26	0·33	0·41	0·54	0·74	1·08
12 0	18·67	0·03	0·07	0·11	0·14	0·19	0·22	0·27	0·34	0·43	0·56	0·77	1·12
6	19·68	0·03	0·07	0·11	0·14	0·19	0·23	0·28	0·35	0·44	0·58	0·80	1·17
13 0	20·70	0·03	0·07	0·11	0·15	0·20	0·24	0·29	0·36	0·46	0·60	0·83	1·21
6	21·75	0·03	0·08	0·12	0·15	0·21	0·25	0·30	0·38	0·47	0·63	0·86	1·25
14 0	22·81	0·03	0·08	0·12	0·16	0·22	0·26	0·31	0·39	0·49	0·65	0·89	1·30
6	23·90	0·04	0·08	0·13	0·16	0·22	0·27	0·33	0·40	0·51	0·67	0·92	1·34
15 0	25·00	0·04	0·08	0·13	0·17	0·23	0·28	0·34	0·42	0·53	0·69	0·95	1·39
6	26·12	0·04	0·09	0·13	0·18	0·24	0·29	0·35	0·43	0·55	0·72	0·98	1·44
16 0	27·26	0·04	0·09	0·14	0·18	0·25	0·30	0·36	0·44	0·56	0·74	1·02	1·48
6	28·42	0·04	0·09	0·14	0·19	0·26	0·30	0·37	0·46	0·58	0·77	1·05	1·53
17 0	29·59	0·04	0·10	0·15	0·19	0·26	0·31	0·38	0·47	0·60	0·79	1·08	1·58
6	30·79	0·04	0·10	0·15	0·20	0·27	0·33	0·40	0·49	0·62	0·82	1·12	1·63
18 0	32·00	0·04	0·10	0·16	0·21	0·28	0·34	0·41	0·50	0·64	0·84	1·15	1·68
6	33·24	0·05	0·10	0·16	0·21	0·29	0·35	0·42	0·52	0·66	0·87	1·19	1·73
19 0	34·48	0·05	0·11	0·17	0·22	0·30	0·36	0·43	0·53	0·68	0·89	1·22	1·78
6	35·76	0·05	0·11	0·17	0·23	0·31	0·37	0·44	0·55	0·70	0·92	1·26	1·84
20 0	37·04	0·05	0·11	0·18	0·23	0·32	0·38	9·46	0·57	0·72	0·95	1·30	1·89
6	38·35	0·05	0·12	0·18	0·24	0·33	0·39	0·47	0·58	0·74	0·97	1·33	1·94
21 0	39·67	0·05	0·12	0·19	0·25	0·33	0·40	0·58	0·60	0·76	1·00	1·37	2·00
6	41·02	0·05	0·12	0·19	0·25	0·34	0·41	0·50	0·62	0·78	1·03	1·41	2·06
22 0	42·37	0·06	0·13	0·20	0·26	0·35	0·42	0·51	0·63	0·80	1·06	1·45	2·11
6	43·76	0·06	0·13	0·20	0·27	0·36	0·43	0·53	0·65	0·83	1·08	1·49	2·17
23 0	45·15	0·06	0·13	0·21	0·27	0·37	0·44	0·54	0·67	0·85	1·11	1·53	2·23
6	46·57	0·06	0·14	0·21	0·28	0·38	0·46	0·55	0·69	0·87	1·14	1·57	2·29
24 0	48·00	0·06	0·14	0·22	0·29	0·39	0·47	0·57	0·70	0·89	1·17	1·61	2·35
6	49·46	0·06	0·14	0·22	0·30	0·40	0·48	0·58	0·72	0·92	1·20	1·65	2·41
25 0	50·92	0·07	0·15	0·23	0·30	0·41	0·49	0·60	0·74	0·94	1·23	1·69	2·47

Mean height		Cubic Yards per lineal foot in level ground	TRANSVERSE SLOPES OF GROUND.											
ft.	in.		One in 30	One in 20	One in 16	One in 14	One in 12	One in 11	One in 10	One in 9	One in 8	One in 7	One in 6	one in 5
25	6	52·43	0·07	0·15	0·24	0·31	0·42	0·51	0·61	0·76	0·96	1·27	1·74	2·53
26	0	53·92	0·07	0·16	0·24	0·32	0·43	0·52	0·63	0·78	0·99	1·30	1·78	2·59
	6	55·46	0·07	0·16	0·25	0·33	0·45	0·53	0·64	0·80	1·01	1·33	1·82	2·65
27	0	57·00	0·07	0·16	0·26	0·33	0·46	0·54	0·66	0·82	1·04	1·36	1·87	2·72
	6	58·57	0·08	0·17	0·26	0·34	0·47	0·56	0·68	0·84	1·06	1·39	1·91	2.79
28	0	60·15	0·08	0·17	0·27	0·35	0.48	0·57	0·69	0·86	1·09	1·43	1·96	2·85
	6	61·76	0·08	0·18	0·27	0·36	0·49	0·58	0.71	0·88	1·11	1·46	2·00	2·92
29	0	63·37	0·08	0·18	0·28	0·37	0·50	0·60	0·72	0·90	1·14	1·49	2·05	2·99
	6	65·02	0·08	0·18	0·29	0·38	0·51	0·61	0·74	0·92	1·16	1·53	2·10	3·06
30	0	66·67	0·08	0·19	0·29	0·38	0·52	0·62	0·76	0·94	1·19	1·56	2.14	3·12
	6	68·35	0·09	0·19	0·30	0·39	0·54	0·64	0·77	0·96	1·22	1·60	2·19	3·19
31	0	70·04	0·09	0·20	0·31	0·40	0·55	0·65	0·79	0·98	1·24	1·63	2·24	3·26
	6	71·76	0·09	0·20	0·31	0·41	0·56	0·67	0·81	1·00	1·27	1·67	2·29	3·34
32	0	73·48	0·09	0·20	0·32	0·42	0·57	0·68	0·83	1·02	1·30	1·70	2·34	3·41
	6	75·24	0·09	0·21	0·33	0·43	0·59	0·70	0·84	1·04	1·33	1·74	2·39	3·48
33	0	77·00	0·09	0·21	0·33	0·44	0·60	0·71	0·86	1·07	1·35	1·78	2·44	3·55
	6	78·79	0·10	0·22	0·34	0·45	0·61	0·73	0·88	1·09	1·38	1·82	2·49	3·63
34	0	80·59	0·10	0·22	0·35	0·46	0·62	0·74	0·90	1·11	1·41	1·85	2·54	3·70
	6	82·42	0·10	0·23	0·36	0·47	0·63	0·76	0·92	1·13	1·44	1·89	2·59	3·78
35	0	84·26	0·10	0·23	0·36	0·47	0·65	0·77	0·94	1·16	1·47	1·93	2·64	3·86
	6	86·13	0·11	0·24	0·37	0·48	0·66	0·79	0·95	1·18	1·50	1·97	2·70	3·94
36	0	88·00	0·11	0·24	0·38	0·49	0·67	0·80	0·97	1·20	1·53	2·01	2·75	4·01
	6	89·90	0·11	0·25	0·39	0·50	0·69	0·82	0·99	1·23	1·56	2·05	2·81	4·09
37	0	91·81	0·11	0·25	0·39	0·51	0·70	0·83	1·01	1·25	1·59	2·09	2·86	4·17
	6	93·75	0·11	0·26	0·40	0·52	0·71	0·85	1·03	1·28	1·62	2·13	2·92	4·25
38	0	95·70	0·12	0·26	0·41	0·53	0·73	0·87	1·05	1·30	1·65	2·17	2·97	4·33
	6	97·68	0·12	0·27	0·42	0·54	0·74	0·88	1·07	1·33	1·68	2·21	3·03	4·42
39	0	99·67	0·12	0·27	0·42	0·55	0·75	0·90	1·09	1·35	1·71	2·25	3·09	4·50
	6	101·68	0·12	0·28	0·43	0·56	0·77	0·92	1·11	1·38	1·75	2·29	3·14	4·58
40	0	103·70	0·12	0·28	0·44	0·57	0·78	0·93	1·13	1·40	1·78	2·33	3·20	4·67
	6	105·75	0·13	0·29	0·45	0·58	0·80	0·95	1·15	1·43	1·81	2·38	3·26	4·75
41	0	107·81	0·13	0·29	0·45	0·59	0·81	0·97	1·17	1·45	1·84	2·42	3·32	4·84
	6	109·90	0·13	0·30	0·46	0·61	0·83	0·99	1·19	1·48	1·88	2·46	3·38	4·93
42	0	112·00	0·13	0·30	0·47	0·62	0·84	1·00	1·21	1·50	1·91	2·51	3·44	5·01
	6	114·13	0·14	0·31	0·48	0·63	0·86	1·02	1·24	2·53	1·94	2·55	3·50	5·10
43	0	116·26	0 14	0 31	0·49	0·64	0 87	1 04	1·26	1·56	1 98	2·59	3·56	5 19
	6	118·42	0·14	0·32	0 50	0·65	0·89	1 06	1 28	1·58	2 01	2·64	3·62	5 28
44	0	120·59	0·14	0·32	0·51	0 66	0·90	1·07	1·30	1·61	2·05	2 68	3 68	5·37
	6	122·79	0·15	0·33	0·51	0 67	0·92	1·09	1·32	1·64	2 08	2·73	3·75	5·46
45	0	125 00	0·15	0·33	0·52	0·68	0 93	1·11	1·35	1 67	2·12	2·78	3 81	5·56
	6	127·24	0·15	0·34	0·53	0·69	0·95	1·13	1·37	1·69	2·15	2 82	3 87	5·65
46	0	129·48	0·15	0·35	0·54	0·71	0·96	1·15	1·39	1·72	2·19	2·87	3·94	5·74
	6	131·76	0·16	0·35	0 55	0·72	0·98	1·17	1·42	1·75	2·22	2.92	4·00	5·84
47	0	134·04	0·16	0·36	0 56	0·73	0·99	1·19	1·44	1·78	2 26	2·97	4·07	5·93
	6	136·35	0·16	0·36	0·57	0·74	1·01	1·21	1·46	1·81	2·30	3·01	4·13	6·03
48	0	138·67	0·16	0·37	0·58	0·75	1·03	1·22	1·48	1·84	2·33	3·06	4·20	6·12
	6	141·02	0·17	0·37	0·59	0·77	1·04	1·24	1·51	1·87	2·37	3·11	4·27	6·22
49	0	143·37	0·17	0·38	0·59	0·78	1·06	1·26	1·53	1·90	2·41	3·16	4·33	6·32
	6	145·76	0·17	0·39	0·60	0·79	1·08	1·28	1·56	1·93	2·45	3·21	4·40	6·42
50	0	148·15	0·17	0·39	0·61	0·80	1·09	1·30	1·58	1·96	2·48	3·26	4·47	6·52

Mean height ft. in.	Cubic Yards per lineal foot in level ground	TRANSVERSE SLOPES OF GROUND. One in 30	One in 20	One in 16	One in 14	One in 12	One in 11	One in 10	One in 9	One in 8	One in 7	One in 6	One in 5
0 6	0·57	0·02	...	...	...	...	...	...	...	...	...	...	...
1 0	1·17	0·02	0·04	0·06	...	...	...	...	...	...	...	...	...
6	1·79	0·02	0·04	0·07	0·09	0·12	0·14	0·17	...	...	...	...	...
2 0	2·44	0·02	0·05	0·07	0·09	0·13	0·15	0·18	0·23	0·29	...	...	...
6	3·13	0·02	0·05	0·08	0·10	0·14	0·17	0·20	0·25	0·32	0·42	0·58	...
3 0	3·83	0·02	0·05	0·08	0·11	0·15	0·18	0·22	0·27	0·34	0·45	0·63	0·93
6	4·57	0·02	0·06	0·09	0·12	0·16	0·20	0·23	0·29	0·37	0·49	0·68	1·01
4 0	5·33	0·03	0·06	0·10	0·13	0·17	0·21	0·25	0·31	0·40	0·52	0·73	1·08
6	6·13	0·03	0·07	0·10	0·14	0·19	0·23	0·27	0·34	0·43	0·56	0·78	1·16
5 0	6·94	0·03	0·07	0·11	0·15	0·20	0·24	0·29	0·36	0·46	0·60	0·83	1·24
6	7·79	0·03	0·08	0·12	0·16	0·22	0·26	0·31	0·39	0·49	0·64	0·89	1·33
6 0	8·67	0·04	0·08	0·13	0·17	0·23	0·27	0·33	0·41	0·52	0·68	0·95	1·41
6	9·57	0·04	0·09	0·13	0·18	0·24	0·29	0·35	0·44	0·55	0·73	1·01	1·50
7 0	10·50	0·04	0·09	0·14	0·19	0·25	0·30	0·37	0·46	0·58	0·77	1·07	1·59
6	11·45	0·04	0·10	0·15	0·20	0·27	0·32	0·39	0·49	0·62	0·82	1·14	1·69
8 0	12·44	0·05	0·10	0·16	0·21	0·29	0·34	0·41	0·51	0·66	0·87	1·20	1·78
6	13·46	0·05	0·11	0·17	0·22	0·31	0·36	0·44	0·54	0·70	0·92	1·27	1·88
9 0	14·50	0·05	0·11	0·18	0·23	0·32	0·38	0·46	0·57	0·73	0·96	1·34	1·98
6	15·57	0·05	0·12	0·19	0·25	0·34	0·40	0·49	0·60	0·77	1·02	1·41	2·09
10 0	16·67	0·06	0·13	0·20	0·26	0·35	0·42	0·51	0·63	0·81	1·07	1·48	2·20
6	17·79	0·06	0·13	0·21	0·27	0·37	0·44	0·54	0·67	0·85	1·13	1·56	2·31
11 0	18·94	0·06	0·14	0·22	0·28	0·39	0·46	0·56	0·70	0·89	1·18	1·63	2·42
6	20·12	0·06	0·15	0·23	0·30	0·41	0·49	0·59	0·74	0·94	1·24	1·71	2·54
12 0	21·33	0·07	0·15	0·24	0·31	0·43	0·51	0·62	0·77	0·98	1·29	1·79	2·66
6	22·57	0·07	0·16	0·25	0·33	0·45	0·54	0·65	0·81	1·03	1·35	1·88	2·79
13 0	23·83	0·07	0·17	0·26	0·34	0·47	0·56	0·68	0·84	1.07	1·41	1·96	2·91
6	25·13	0·07	0·17	0·27	0·35	0·49	0·59	0·71	0·88	1.12	1·48	2·05	3·04
14 0	26·44	0·08	0·18	0·28	0·37	0·51	0·61	0·74	0·91	1.17	1·54	2·13	3·16
6	27·79	0·08	0·19	0·30	0·39	0·53	0·64	0·77	0·95	1.22	1·61	2·22	3·30
15 0	29·17	0·09	0·20	0·31	0·40	0·55	0·66	0·80	0·99	1·26	1·67	2·31	3·48
6	30·57	0·09	0·20	0·32	0·42	0·58	0·69	0·83	1·03	1·32	1·74	2·41	3·57
16 0	32·00	0·09	0·21	0·33	0·44	0·60	0·71	0·86	1·07	1·37	1·81	2·50	3·71
6	33·46	0·10	0·22	0·34	0·46	0·62	0·74	0·90	1·11	1·43	1·88	2·60	3·86
17 0	34·94	0·10	0·23	0·36	0·47	0·64	0·77	0·93	1·16	1·48	1·95	2·70	4·00
6	36·46	0·11	0·24	0·37	0·49	0·67	0·80	0·96	1·20	1·54	2·02	2·80	4·16
18 0	38·00	0·11	0·25	0·39	0·51	0·69	0·83	1·00	1·24	1·59	2·09	2·90	4·31
6	39·57	0·11	0·26	0·40	0·53	0·72	0·86	1·04	1·29	1·65	2·17	3·01	4·47
19 0	41·17	0·12	0·26	0·41	0·54	0·74	0·89	1·08	1·34	1·70	2·25	3·11	4·62
6	42·79	0·12	0·27	0·43	0·56	0·77	0·92	1·12	1·39	1·76	2·33	3·22	4·78
20 0	44·44	0·13	0·28	0·44	0·58	0·79	0·95	1·15	1·43	1·82	2·41	3·33	4·94
6	46·12	0·13	0·29	0·46	0·60	0·82	0·98	1·19	1·48	1·89	2·49	3·45	5·11
21 0	47·83	0·13	0·30	0·47	0·62	0·85	1·01	1·23	1·53	1·95	2·57	3·56	5·28
6	49·57	0·14	0·31	0·49	0·64	0·88	1·05	1·27	1·58	2·01	2·66	3·68	5·45
22 0	51·33	0·14	0·32	0·50	0·66	0·90	1·08	1·31	1·63	2·07	2·74	3·79	5·63
6	53·12	0·15	0·33	0·52	0·68	0·93	1·12	1·35	1·68	2·14	2·83	3·91	5·81
23 0	54·94	0·15	0·34	0·54	0·70	0·96	1·15	1·39	1·73	2·20	2·91	4·03	5·98
6	56·79	0·16	0·35	0·55	0·73	0·99	1·19	1·44	1·78	2·27	3·00	4·16	6·17
24 0	58·67	0·16	0·36	0·57	0·75	1·02	1·22	1·48	1·83	2·34	3·09	4·28	6·35
6	60·57	0·17	0·37	0·59	0·77	1·05	1·26	1·53	1·88	2·41	3·18	4·41	6·54
25 0	62·50	0·17	0·38	0·60	0·79	1·08	1·29	1·57	1·94	2·48	3·27	4·54	6·73

Mean height		Cubic Yards per lineal foot in level ground	TRANSVERSE SLOPES OF GROUND.											
			one in 30	one in 20	one in 16	one in 14	one in 12	one in 11	one in 10	one in 9	one in 8	one in 7	one in 6	one in 5
ft	in.													
25	6	64·46	0·18	0·40	0·62	0·82	1·11	1·32	1·62	2·00	2·55	3·37	4·67	6·93
26	0	66·44	0·18	0·41	0·64	0·84	1·14	1·36	1·66	2·06	2·62	3·46	4·80	7·12
	6	68·46	0·19	0·42	0·66	0·86	1·18	1·40	1·71	2·12	2·70	3·56	4·94	7·32
27	0	70·50	0·19	0·43	0·67	0·88	1·21	1·44	1·75	2·17	2·77	3·66	5·07	7·52
	6	72·57	0·20	0·44	0·69	0·91	1·24	1·48	1·80	2·23	2·85	3·76	5·21	7·73
28	0	74·67	0·20	0·45	0·71	0·93	1.27	1·52	1·85	2·29	2·92	3·86	5·35	7·93
	6	76·79	0·21	0·46	0·73	0·96	1·31	1·56	1.90	2·35	3·00	3·97	5·49	8·15
29	0	78·94	0·21	0·48	0·75	0·98	1·34	1·60	1·95	2·41	3·08	4·07	5·63	8·36
	6	81·12	0·22	0·49	0·77	1·01	1·38	1·64	2·00	2·48	3·16	4·18	5·78	8·58
30	0	83·33	0·22	0·50	0·79	1·03	1·41	1·68	2·05	2·54	3·24	4·28	5.93	8·79
	6	85·57	0·23	0·51	0·81	1·06	1·45	1·73	2·10	2·61	3·32	4·39	6·08	9·02
31	0	87·83	0·23	0·53	0·83	1·08	1·48	1·77	2·15	2·67	3·40	4·49	6·23	9·24
	6	90·12	0·24	0·54	0·85	1·11	1·52	1·82	2·21	2·74	3·49	4·61	6·38	9·47
32	0	92·44	0·25	0·55	0·87	1·14	1·56	1·86	2·26	2·80	3·57	4·72	6·53	9·69
	6	94·79	0·25	0·57	0·89	1·17	1·60	1·91	2·31	2·87	3·66	4·83	6·69	9·93
33	0	97·17	0·26	0·58	0·91	1·19	1·63	1·95	2·36	2·93	3·74	4·94	6·85	10·16
	6	99·57	0·26	0·59	0·93	1·22	1·67	2·00	2·42	3·00	3·83	5·06	7·01	10·40
34	0	102·00	0·27	0·61	0·95	1·25	1·71	2·04	2·48	3·07	3·92	5·18	7·17	10·64
	6	104·45	0·28	0·62	0·98	1·28	1·75	2·09	2·54	3.14	4·01	5·29	7·34	10·89
35	0	106·94	0·28	0·64	1·00	1·31	1·79	2·13	2·59	3·21	4·10	5·41	7·50	11·13
	6	109·45	0·29	0·65	1·02	1·34	1·83	2·18	2·65	3·28	4·19	5·54	7·67	11·38
36	0	112·00	0·29	0·66	1·04	1·37	1·87	2·23	2·71	3·36	4·28	5·66	7·84	11·63
	6	114·57	0·30	0·68	1·07	1·40	1·91	2·28	2·77	3·44	4·38	5·78	8·01	11·89
37	0	117·17	0·31	0·69	1·09	1·43	1·95	2·33	2·82	3·51	4·47	5·90	8·18	12·14
	6	119·79	0·31	0·71	1·11	1·46	1·99	2·38	2·89	3·59	4·57	6·03	8·36	12·40
38	0	122·44	0·32	0·72	1·13	1.49	2·03	2·43	2·95	3·66	4·66	6·16	8·53	12·66
	6	125·12	0·33	0·74	1·16	1.52	2·08	2·48	3·01	3·74	4·76	6·29	8·71	12·93
39	0	127·83	0·33	0·75	1·18	1.55	2·12	2·53	3·07	3·81	4·86	6·42	8·89	13·19
	6	130·57	0·34	0·77	1·21	1.58	2·16	2·58	3·14	3·89	4·96	6·55	9·08	13·47
40	0	133·33	0·35	0·79	1·23	1·61	2·20	2·63	3·20	3·97	5·06	6·68	9·26	13·74
	6	136·12	0·35	0·80	1·26	1·65	2·25	2·69	3·27	4·05	5·17	6·82	9·45	14·02
41	0	138·94	0·36	0·82	1·28	1·68	2·29	2·74	3·33	4·13	5·27	6·95	9·63	14·29
	6	141·79	0·37	0·83	1·31	1·71	2·34	2·80	3·40	4·21	5·37	7·09	9·82	14·58
42	0	144·67	0·38	0·85	1·33	1·74	2·38	2·85	3·46	4·29	5·47	7·23	10·01	14·86
	6	147·57	0·39	0·87	1·36	1·78	2·43	2·91	3·53	4·38	5·58	7·37	10·21	15·15
43	0	150·50	0 39	0 88	1·38	1·81	2·48	2·96	3·59	4·46	5·69	7·51	10·40	15 43
	6	153·46	0·40	0·90	1·41	1·85	2·53	3·02	3·66	4·55	5·80	7·66	10·60	15·73
44	0	156·44	0·41	0·92	1·44	1·88	2·57	3·07	3·73	4·63	5·90	7·80	10 80	16·02
	6	159·46	0·41	0·93	1·47	1·92	2·62	3·13	3·80	4·72	6·01	7·95	11·00	16·32
45	0	162·50	0·42	0·95	1·49	1·95	2·67	3·18	3·87	4·80	6·12	8·09	11·20	16·62
	6	165·57	0·43	0·97	1·52	1·99	2·72	3·24	3·94	4 89	6·24	8·24	11·42	16·93
46	0	168·67	0·44	0·99	1·54	2·02	2·77	3·30	4·01	4·98	6 35	8·38	11·61	17·23
	6	171·79	0·44	1·00	1·57	2·06	2·82	3·36	4·08	5 07	6·47	8.54	11·82	17·54
47	0	174·94	0·45	1·02	1·60	2·10	2·87	3·42	4·15	5·16	6.58	8·69	12·03	17·85
	6	178·12	0·46	1·04	1·63	2·14	2·92	3·48	4·23	5·25	6·70	8·84	12·25	18·17
48	0	181·33	0·47	1·06	1·66	2·17	2·97	3·54	4·30	5·34	6·81	8·99	12·46	18·48
	6	184·57	0·48	1·08	1·69	2·21	3·02	3·60	4·38	5·43	6·93	9·15	12·68	18·81
49	0	187·83	0·48	1·09	1·71	2·25	3·07	3·66	4·45	5·52	7·05	9·31	12·89	19·13
	6	191·12	0·49	1·11	1·74	2·29	3·12	3·73	4·53	5·62	7·17	9·47	13·11	19·46
50	0	194·44	0·50	1·13	1·77	2·32	3·17	3·79	4·60	5·71	7·29	9·62	13·33	19·78

TABLE IV. Continued—Base 30 Feet, Side Slopes 2 to 1.

Mean height	Cubic Yards per lineal foot in level ground	TRANSVERSE SLOPES OF GROUND.											
ft. in.		One in 30	One in 20	One in 16	One in 14	One in 12	One in 11	One in 10	One in 9	One in 8	One in 7	one in 6	One in 5
0 6	0·57	0·01	...	...	...	...	...	...	...	...	...	...	...
1 0	1·18	0·02	0·05	0·08	...	...	...	...	...	...	...	...	...
6	1·83	0·03	0·06	0·10	0·13	0·17	0·21	0·25	...	...	...	...	...
2 0	2·52	0·03	0·07	0·11	0·14	0·19	0·23	0·28	0·35	0·45	...	...	...
6	3·24	0·03	0·08	0·12	0·15	0·21	0·25	0·31	0·39	0·50	0·66	0·93	...
3 0	4·00	0 04	0·08	0·13	0·17	0·23	0·28	0·34	0·42	0·54	0·73	1·02	1·56
6	4·80	0·04	0·09	0·15	0·18	0·25	0·30	0·37	0·46	0·60	0·80	1·12	1·72
4 0	5·63	0·04	0 10	0·16	0·20	0·28	0·33	0·41	0·51	0·65	0·87	1·22	1·87
6	6·50	0·05	0·11	0·17	0 22	0·30	0·37	0·44	0 55	0·71	0·95	1·34	2·03
5 0	7·41	0·05	0·12	0·18	0·24	0·33	0·40	0·48	0·60	0·77	1·03	1·45	2·20
6	8·35	0·06	0·13	0·20	0·26	0·36	0·43	0·52	0·65	0·84	1·12	1·57	2·38
6 0	9·33	0·06	0·14	0·21	0·28	0·39	0·46	0·56	0·70	0·90	1·20	1·69	2·57
6	10·35	0·07	0·15	0·23	0·30	0·42	0·50	0·60	0·75	0·97	1·29	1·82	2·77
7 0	11·41	0·07	0·16	0·25	0·32	0·44	0·53	0·65	0·81	1·04	1·38	1·95	2·97
6	12·50	0·08	0·17	0·27	0·34	0·47	0·57	0·69	0·86	1·11	1·48	2·09	3·18
8 0	13·63	0·08	0·18	0·28	0·37	0·51	0·61	0·74	0·92	1·19	1·58	2·22	3·39
6	14·80	0·09	0·19	0·30	0·39	0·54	0·65	0·79	0·98	1·26	1·69	2·37	3·61
9 0	16·00	0·09	0·20	0·32	0·42	0·58	0·69	0·84	1·05	1·34	1·79	2·52	3·84
6	17·24	0·10	0·22	0·34	0·45	0·61	0·73	0·89	1·11	1·43	1·90	2·68	4·08
10 0	18·52	0·10	0·23	0·36	0·47	0·65	0·78	0·95	1·18	1·51	2·02	2·84	4·32
6	19·83	0·11	0·25	0·38	0·50	0·68	0·82	1·00	1·25	1·60	2·13	3·01	4·57
11 0	21·18	0·11	0·26	0·40	0·53	0·72	0·87	1·06	1·32	1·69	2 25	3·17	4·83
6	22·57	0·12	0·27	0·43	0·56	0·76	0·92	1 12	1·39	1·79	2·38	3·34	5·09
12 0	24 00	0·13	0·28	0·45	0·59	0·80	0·96	1·17	1·46	1·88	2·50	3·52	5·36
6	25·46	0·14	0·30	0·47	0·62	0·85	1·01	1·23	1·54	1·98	2 63	3·71	5·64
13 0	26·96	0·14	0·31	0·49	0·65	0·89	1·06	1·30	1·62	2.08	2·77	3·89	5·93
6	28·50	0·15	0·33	0·52	0·68	0·94	1·11	1·36	1·70	2.18	2·90	4·08	6·22
14 0	30·07	0·15	0·35	0·54	0·71	0·98	1·17	1·43	1·78	2.28	3·04	4·28	6·52
6	31·68	0·16	0·37	0·57	0·74	1·03	1·22	1·50	1·86	2.39	3·19	4·49	6·83
15 0	33·33	0·17	0·38	0·60	0·78	1·07	1·28	1·56	1·95	2·50	3·33	4·69	7·14
6	35·02	0·18	0·40	0·63	0·81	1·12	1·34	1·63	2·03	2·61	3·48	4·90	7·46
16 0	36·74	0·18	0·41	0·65	0·85	1·17	1·40	1·70	2·12	2·73	3·64	5·11	7·79
6	38·50	0·19	0·43	0·68	0·89	1 22	1·46	1·78	2·21	2·84	3·79	5·33	8·13
17 0	40·29	0·20	0·45	0·71	0·93	1·27	1·52	1·85	2·31	2·96	3 95	5·56	8·47
6	42·12	0·21	0·47	0·74	0·97	1·32	1·58	1·93	2·40	3·09	4·12	5·79	8·82
18 0	44 00	0·22	0·49	0·76	1·00	1·38	1·65	2·01	2·50	3·21	4·28	6·02	9·17
6	45·92	0·23	0·51	0·80	1·04	1·43	1·71	2·09	2·60	3·34	4·45	6·26	9·54
19 0	47·85	0·23	0·53	0·83	1·08	1·49	1·78	2·17	2·70	3·47	4·62	6·50	9·91
6	49·83	0·24	0·55	0·86	1·13	1·55	1·85	2·25	2·80	3·60	4·80	6·75	10·29
20 0	51·85	0·25	0·57	0·89	1·17	1·60	1·92	2·33	2·91	3·73	4 98	7·00	10·67
6	53·91	0·26	0·59	0·93	1·21	1·66	1·99	2·42	3·01	3·87	5·17	7·26	11·06
21 0	56·00	0·27	0·61	0·96	1·25	1·72	2·06	2·51	3·12	4·01	5·35	7·52	11·46
6	58·14	0·28	0·63	0 99	1·30	1·78	2·13	2·60	3·23	4·15	5·54	7·79	11·87
22 0	60·30	0·29	0·65	1·02	1·34	1·84	2·20	2·69	3·35	4·30	5·73	8·06	12·28
6	62·50	0·30	0·68	1·06	1·39	1·90	2·28	2·78	3·46	4·44	5·93	8·33	12·70
23 0	64·74	0·31	0·70	1·09	1·44	1·97	2·36	2·87	3·58	4·59	6·12	8·61	13·12
6	67·02	0·32	0·72	1·13	1·49	2·03	2·44	2·97	3·70	4·75	6·33	8·90	13·56
24 0	69·33	0·33	0·74	1·17	1·53	2·10	2·51	3·06	3·82	4·90	6·53	9·19	14·00
6	71·69	0·34	0·77	1·21	1·58	2 17	2·59	3·16	3·94	5·06	6·74	9·48	14·45
25 0	74·07	0·35	0·79	1·24	1·63	2·24	2·67	3·26	4·06	5·22	6·95	9·78	14·90

Mean height	Cubic yards per lineal foot in level ground	TRANSVERSE SLOPES OF GROUND.											
		one in 30	one in 20	one in 16	one in 14	one in 12	one in 11	one in 10	one in 9	one in 8	one in 7	one in 6	one in 5
ft. in													
25 6	76·50	0·36	0·81	1·28	1·68	2·30	2·76	3·36	4·19	5·38	7·17	10·08	15·36
26 0	78·96	0·37	0·84	1·32	1·73	2·37	2·84	3·46	4·32	5·54	7·39	10·39	15·83
6	81·46	0·38	0·87	1·36	1·79	2·45	2·93	3·57	4·45	5·71	7·62	10·71	16·31
27 0	84·00	0·39	0·89	1·40	1·84	2·52	3·01	3·67	4·58	5·88	7·84	11·02	16·79
6	86·57	0·41	0·92	1·44	1·89	2·60	3·10	3·78	4·72	6·05	8·07	11·34	17·28
28 0	89·19	0·42	0·94	1·48	1·94	2·67	3·19	3·89	4·85	6·22	8·30	11·67	17·78
6	91·83	0·43	0·97	1·53	2·00	2·75	3·28	4·00	4·99	6·40	8·54	12·01	18·29
29 0	94·52	0·44	1·00	1·57	2·06	2·82	3·37	4·11	5·13	6·58	8·77	12·34	18·80
6	97·24	0·45	1·03	1·61	2·12	2·90	3·47	4·23	5·27	6·76	9·01	12·68	19·32
30 0	100·00	0·46	1·05	1·65	2·17	2·98	3·56	4·34	5·41	6·94	9·26	13·02	19·84
6	102·80	0·48	1·08	1·70	2·23	3·06	3·66	4·46	5·56	7·13	9·51	13·37	20·38
31 0	105·63	0·49	1·11	1·74	2·29	3·14	3·75	4·57	5·70	7·32	9·76	13·72	20·91
6	108·50	0·51	1·14	1·79	2·35	3·22	3·85	4·69	5·85	7·51	10·02	14·08	21·46
32 0	111·41	0·52	1·17	1·83	2·41	3·30	3·95	4·81	6·00	7·70	10·27	14·44	22·01
6	114·35	0·53	1·20	1·88	2·47	3·39	4·05	4·94	6·16	7·90	10·53	14·81	22·57
33 0	117·33	0·54	1·23	1·93	2·53	3·47	4·15	5·06	6·31	8·10	10·80	15·19	23·14
6	120·35	0·56	1·26	1·98	2·60	3·56	4·26	5·19	6·47	8·30	11·07	15·57	23·72
34 0	123·41	0·57	1·29	2·02	2·66	3·64	4·36	5·31	6·63	8·50	11·34	15·95	24·30
6	126·50	0·59	1·32	2·07	2·73	3·73	4·47	5·44	6·79	8·71	11 62	16·33	24·89
35 0	129·63	0·60	1·35	2·12	2·79	3·82	4·57	5·57	6·95	8·92	11·89	16·72	25·48
6	132·80	0·62	1·39	2·17	2·86	3·91	4·68	5·71	7·12	9·13	12·17	17·12	26·09
36 0	136·00	0·63	1·42	2·22	2·92	4·00	4·79	5·84	7·28	9·34	12·46	17·52	26·70
6	139·24	0·64	1·45	2·28	2·99	4·10	4·90	5·98	7·45	9·56	12·75	17·93	27·32
37 0	142·52	0·65	1·48	2·33	3·06	4·19	5·01	6·11	7·62	9·78	13·04	18·34	27·94
6	145·83	0·67	1·52	2·38	3·13	4·29	5·13	6·25	7·80	10·00	13·33	18·76	28·57
38 0	149·19	0·68	1·55	2·43	3·19	4·38	5·24	6·39	7·97	10·22	13·63	19·17	29·21
6	152·57	0·70	1·59	2·49	3·26	4·48	5·36	6·53	8·15	10·45	13·94	19·59	29·86
39 0	156·00	0·71	1·62	2.54	3·34	4·58	5·48	6·67	8·32	10·68	14·24	20·02	30·51
6	159·46	0·73	1·66	2·60	3·41	4·68	5·60	6·82	8·50	10·91	14·55	20·46	31·17
40 0	162·96	0·75	1·69	2·65	3·48	4·78	5·71	6·96	8·68	11·14	14·86	20·89	31·83
6	166·50	0·77	1·73	2·61	3·56	4·88	5.83	7·11	8·87	11·38	15·18	21·33	32·51
41 0	170·07	0·78	1·76	2·77	3·63	4·98	5·96	7·26	9·05	11·62	15·49	21·78	33·19
6	173·68	0·80	1·80	2·83	3·71	5·09	6·08	7·41	9·24	11·86	15·81	22·24	33·88
42 0	177·33	0·81	1·83	2·88	3·78	5·19	6·20	7·56	9·43	12·10	16·13	22·69	34·57
6	181·02	0·83	1·87	2·94	3·86	5·30	6·33	7·72	9·62	12·35	16.46	23·15	35·27
43 0	184·74	0·84	1·91	3.00	3·94	5·40	6·46	7·87	9·81	12·59	16·79	23·61	35·98
6	188·50	0·86	1·95	3.06	4·02	5·51	6·59	8·03	10·01	12·84	17·13	24·08	36·70
44 0	192·30	0·88	1·98	3.12	4·09	5·61	6·72	8·18	10·21	13·10	17·46	24·56	37·42
6	196·13	0·90	2·02	3.18	4·17	5·72	6·85	8·34	10·41	13·36	17·80	25·04	38·16
45 0	200·00	0·91	2·06	3.24	4·25	5·83	6·98	8·51	10·61	13·61	18·15	25·52	38·89
6	203·91	0·93	2·10	3.31	4·34	5·95	7·12	8·67	10·81	13·87	18·50	26·01	39·63
46 0	207·85	0·95	2·14	3.37	4·42	6·06	7·25	8·83	11·01	14·13	18·85	26·50	40·38
6	211·83	0·97	2·18	3.43	4·50	6·18	7·39	9·00	11·22	14·40	19·21	27·00	41·14
47 0	215·85	0·98	2.22	3.49	4·58	6·29	7·52	9·17	11·43	14·67	19·56	27·50	41·91
6	219·91	1·00	2·26	3·56	4·67	6·41	7·66	9·34	11·64	14·94	19·92	28·01	42·69
48 0	224·00	1·02	2·30	3·62	4·75	6·52	7·80	9·51	11·85	15·21	20·28	28·52	43·46
6	228·13	1·04	2·34	3·69	4·84	6·64	7·94	9·68	12·07	15·49	20·65	29·04	44·25
49 0	232·30	1·06	2·39	3·75	4·93	6·76	8·08	9·85	12·28	15·76	21·02	29·56	45·04
6	236·50	1·08	2·43	3·82	5·02	6·88	8·23	10·03	12·50	16·04	21·40	30·08	45·84
50 0	240·74	1·09	2·47	3·89	5·10	7·00	8·37	10.20	12·72	16·33	21·77	30·61	46·65

breadth of base in feet.	BREADTH OF BASE OF CUTTING IN FEET.											
	0	1	2	3	4	5	6	7	8	9	10	11
0	0·00	0·01	0·02	0·06	0·10	0·15	0·22	0·30	0·40	0·50	0·62	0·75
1	0·01	0·02	0·04	0·08	0·13	0·19	0·27	0·35	0·45	0·56	0·69	0·82
2	0·02	0·04	0·07	0·12	0·17	0·24	0·32	0·41	0·52	0·64	0·77	0·91
3	0·06	0·08	0·12	0·17	0·23	0·30	0·39	0·49	0·60	0·72	0·86	1·01
4	0·10	0·13	0·17	0·23	0·30	0·38	0·47	0·57	0·69	0·82	0·96	1·12
5	0·15	0·19	0·24	0·30	0·38	0·46	0·56	0·67	0·80	0·93	1·08	1·24
6	0·22	0·27	0·32	0·39	0·47	0·56	0·66	0·78	0·91	1·05	1·21	1·38
7	0·30	0·35	0·41	0·49	0·57	0·67	0·78	0·91	1·04	1·19	1·35	1·52
8	0·40	0·45	0·52	0·60	0·69	0·80	0·91	1·04	1·18	1·34	1·51	1·69
9	0·50	0·56	0·64	0·72	0·82	0·93	1·05	1·19	1·34	1·50	1·67	1·86
10	0·62	0·69	0·77	0·86	0·96	1·08	1·21	1·35	1·51	1·69	1·85	2·04
11	0·75	0·82	0·91	1·01	1·12	1·24	1·38	1·52	1·69	1·86	2·04	2·24
12	0·89	0·97	1·06	1·17	1·28	1·41	1·56	1·71	1·88	2·06	2·25	2·45
13	1·04	1·13	1·23	1·34	1·46	1·60	1·75	1·91	2·08	2·27	2·46	2·67
14	1·21	1·30	1·41	1·52	1·65	1·80	1·95	2·12	2·30	2·49	2·69	2·91
15	1·39	1·49	1·60	1·72	1·86	2·01	2·17	2·34	2·52	2·72	2·93	3·15
16	1·58	1·69	1·80	1·93	2·07	2·23	2·39	2·57	2·77	2·97	3·18	3·41
17	1·78	1·90	2·02	2·15	2·30	2·46	2·63	2·82	3·02	3·23	3·45	3·69
18	2·00	2·12	2·25	2·39	2·54	2·71	2·89	3·08	3·28	3·50	3·73	3·97
19	2·23	2·35	2·49	2·64	2·80	2·97	3·15	3·35	3·56	3·78	4·02	4·27
20	2·47	2·60	2.74	2·90	3·06	3·24	3·43	3·64	3·85	4·08	4·32	4·57
21	2·72	2·86	3·01	3·17	3·34	3·52	3·72	3·93	4·15	4·39	4·63	4·89
22	2·99	3·13	3·28	3·45	3·63	3·82	4·02	4·24	4·47	4·71	4·96	5·22
23	3·27	3·41	3·57	3·75	3·93	4·13	4·34	4.56	4·80	5·04	5·30	5·57
24	3·56	3·71	3·88	4·06	4·24	4·45	4·67	4·89	5·14	5·38	5·65	5·93
25	3·86	4·02	4·19	4·38	4·57	4·78	5·01	5·24	5·49	5·75	6·02	6·30
26	4·17	4·34	4·52	4·71	4·91	5·13	5·36	5·60	5·85	6·12	6·40	6·68
27	4·50	4·67	4 86	5·05	5·26	5·49	5·72	5·97	6·23	6·50	6·78	7·08
28	4·84	5·02	5·21	5·41	5·63	5·86	6·10	6·35	6·62	6·90	7·19	7·49
29	5·19	5·38	5·57	5·78	6·01	6·24	6·49	6·75	7·02	7·30	7·60	7·91
30	5·56	5·75	5·95	6·17	6·40	6·64	6·89	7·15	7·43	7·72	8·02	8·34
31	5·93	6·13	6·34	6·56	6·80	7·04	7·30	7·57	7·86	8·15	8·46	8·78
32	6·32	6·52	6·74	6·97	7·21	7·46	7·73	8·00	8·30	8·59	8·90	9·23
33	6·72	6·93	7·15	7·39	7·63	7·89	8·17	8·45	8·75	9·05	9·37	9·70
34	7·14	7·35	7·58	7·82	8·07	8·34	8·62	8·91	9·21	9·52	9·85	10·19
35	7·56	7·78	8·02	8·27	8·52	8·80	9·08	9·38	9·68	10·01	10·34	10·69
36	8·00	8·23	8·47	8·72	8·99	9·27	9·56	9·86	10·17	10·50	10·84	11·19
37	8·45	8·69	8·93	9·19	9·46	9·75	10·04	10·35	10·67	11·01	11·35	11·71
38	8·91	9·15	9·41	9·67	9·95	10·24	10·54	10·86	11·18	11·52	11·87	12·24
39	9·39	9·64	9·90	10·17	10·45	10·75	11·05	11·38	11·71	12·06	12·41	12·78
40	9·88	10·13	10·40	10·67	10·96	11·27	11·58	11·91	12·25	12·60	12·96	13·34
41	10·38	10·64	10·91	11·19	11·49	11·80	12·12	12·45	12·80	13·15	13·53	13·91
42	10·89	11·15	11·43	11·72	12·02	12·34	12·67	13·01	13·36	13·72	14·10	14·49
43	11·41	11·69	11·97	12·27	12·57	12·89	13·23	13·57	13·93	14·30	14·69	15·08
44	11·95	12·23	12·52	12·82	13·14	13·46	13·80	14·15	14·52	14·90	15·29	15·69
45	12·50	12·78	13·08	13·39	13·71	14·04	14·39	14·75	15·12	15·50	15·90	16·30
46	13·06	13·35	13·65	13·97	14·30	14·64	14·99	15·36	15·73	16·12	16·53	16·93
47	13·64	13·93	14·24	14·56	14·90	15·24	15·60	15·97	16·35	16·75	17·16	17·58
48	14·22	14·52	14·84	15·17	15·51	15·86	16·22	16·60	16·99	17·39	17·80	18·23
49	14·82	15·13	15·45	15·78	16·13	16·49	16·86	17·24	17·64	18·04	18·46	18·89
50	15·43	15·75	16·07	16·41	16·77	17·13	17·51	17·90	18·30	18·71	19·14	19·57

breadth of base in feet.	BREADTH OF BASE OF CUTTING IN FEET											
	12	13	14	15	16	17	18	19	20	21	22	23
0	0·89	1·04	1·21	1·39	1·58	1·78	2·00	2·23	2·47	2·72	2·99	3·27
1	0·97	1·13	1·30	1·49	1·69	1·90	2·12	2·35	2·60	2·86	3·13	3·41
2	1·06	1·23	1·41	1·60	1·80	2·02	2·25	2·49	2·74	3·01	3·28	3·57
3	1·17	1·34	1·52	1·72	1·93	2·15	2·39	2·64	2·90	3·17	3·45	3·75
4	1·28	1·46	1·65	1·86	2·07	2·30	2·54	2·80	3·06	3·34	3·63	3·93
5	1·41	1·60	1·80	2·01	2·23	2·46	2·71	2·97	3·24	3·52	3·82	4·13
6	1·56	1·75	1·95	2·17	2·39	2·63	2·89	3·15	3·43	3·72	4·02	4·34
7	1·71	1·91	2·12	2·34	2·57	2·82	3·08	3·35	3·64	3·93	4·24	4·56
8	1·88	2·08	2·30	2·52	2·77	3·02	3·28	3·56	3·85	4·15	4·47	4·80
9	2·06	2·27	2·49	2·72	2·97	3·23	3·50	3·78	4·08	4·39	4·71	5·04
10	2·25	2·46	2·69	2·93	3·18	3·45	3·73	4·02	4·32	4·63	4·96	5·30
11	2·45	2·67	2·91	3.15	3·41	3·69	3·97	4·27	4·57	4·89	5·22	5·57
12	2·67	2·90	3·14	3·39	3·65	3·93	4·22	4·52	4·84	5·16	5·50	5·85
13	2·90	3·13	3·38	3·64	3·91	4·19	4·49	4·80	5·12	5·45	5·80	6·15
14	3·14	3·38	3·63	3·90	4·17	4·46	4·77	5·08	5·41	5·75	6·10	6·46
15	3·39	3·64	3·90	4·17	4·45	4·75	5·06	5·38	5·71	6·06	6·41	6·78
16	3·65	3·91	4·17	4·45	4·74	5·04	5·36	5·69	6·02	6·38	6·74	7·12
17	3·93	4·19	4·46	4·75	5·04	5·35	5·67	6·01	6·35	6·71	7·08	7·46
18	4·22	4·49	4·77	5·06	5·36	5·67	6·00	6·34	6·69	7·06	7·43	7·82
19	4·52	4·80	5·08	5·38	5.69	6·01	6·34	6·69	7·04	7·41	7·80	8·19
20	4·84	5·12	5·41	5·71	6·02	6·35	6·69	7·04	7·41	7·78	8·17	8·57
21	5·16	5·45	5·75	6·06	6·38	6·71	7·06	7·41	7·78	8·17	8·56	8·97
22	5·50	5·80	6·10	6·41	6·74	7·08	7.43	7·80	8·17	8·56	8·96	9·38
23	5·85	6·15	6·46	6·78	7·12	7·46	7·82	8·19	8·57	8·97	9·38	9·80
24	6·21	6·52	6·84	7·17	7·51	7·86	8·22	8·60	8·99	9·39	9·80	10·23
25	6·59	6·91	7·23	7·56	7·91	8·27	8·64	9·02	9·41	9·82	10·24	10·67
26	6·98	7·30	7·63	7·97	8·32	8·69	9·06	9·45	9·85	10·27	10·69	11·13
27	7·38	7·71	8·04	8·39	8·75	9·12	9·50	9·90	10·30	10·72	11·15	11·60
28	7·80	8·13	8·47	8·82	9·19	9·56	9·95	10·35	10·77	11·19	11·63	12·08
29	8·23	8·56	8·91	9·27	9·64	10·02	10·41	10·82	11·24	11·67	12·12	12·57
30	8·67	9·01	9·36	9·72	10·10	10·49	10·89	11·30	11·73	12·17	12·62	13·08
31	9·12	9·46	9·82	10·19	10·57	10·97	11 38	11·80	12·23	12·67	13·13	13·60
32	9·58	9·93	10·30	10·67	11·06	11·46	11·88	12·30	12·74	13·19	13·65	14·13
33	10·05	10·41	10·78	11·17	11·56	11·97	12·39	12·82	13·27	13·72	14·19	14·67
34	10·54	10·91	11·28	11·67	12·07	12·49	12·91	13·35	13·80	14·27	14·74	15·23
35	11·04	11·41	11·80	12·19	12·60	13·02	13·45	13·90	14·35	14·82	15·30	15·80
36	11·55	11·93	12·32	12·72	13·14	13·56	14·00	14·45	14·91	15·39	15·88	16·38
37	12·08	12·46	12·86	13·27	13·69	14·12	14·56	15·02	15·49	15·97	16·46	16·97
38	12·61	13·01	13·41	13·82	14·25	14·69	15·14	15·60	16·07	16·56	17·06	17·57
39	13·16	13·56	13·97	14·39	14·82	15·27	15·72	16·19	16·67	17·17	17·67	18·19
40	13·73	14·13	14·54	14·97	15·41	15·86	16·32	16·80	17·28	17·78	18·30	18·82
41	14·30	14·71	15·13	15·56	16·01	16·46	16·93	17·41	17·91	18.41	18·93	19·46
42	14·89	15·30	15·73	16·17	16·62	17·08	17·56	18·04	18·54	19·06	19·58	20·12
43	15·49	15·91	16·34	16·78	17·24	17·71	18·19	18·69	19·19	19·71	20·24	20·78
44	16·10	16·52	16·96	17·41	17·88	18·35	18·84	19·34	19·85	20·38	20·91	21·46
45	16·72	17·15	17·60	18·06	18·53	19·01	19·50	20·01	20·53	21·06	21·60	22·15
46	17·36	17·80	18·25	18·71	19·19	19·67	20·17	20·69	21·21	21·75	22·30	22·86
47	18·00	18·45	18·91	19·38	19·86	20·35	20·86	21·38	21·91	22·45	23·01	23·57
48	18·66	19·12	19·58	20·06	20·54	21·04	21·56	22·08	22·62	23·17	23·73	24·30
49	19·34	19·80	20·27	20·75	21·24	21·75	22·27	22·80	23·34	23·90	24·46	25·04
50	20·03	20·49	20·96	21·45	21·95	22·46	22·99	23·53	24·07	24·64	25·21	25·80

breadth of base in feet.	BREADTH OF BASE OF CUTTING IN FEET.											
	24	25	26	27	28	29	30	31	32	33	34	35
0	3·56	3·86	4·17	4·50	4·84	5·19	5·56	5·93	6·32	6·72	7·14	7·56
1	3·71	4·02	4·34	4·67	5·02	5·38	5·75	6·13	6·52	6·93	7·35	7·78
2	3·88	4·19	4·52	4 86	5·21	5·57	5·95	6·34	6·74	7·15	7·58	8·02
3	4·06	4·38	4·71	5·05	5·41	5·78	6·17	6·56	6·97	7·39	7·82	8·27
4	4·24	4·57	4·91	5·26	5·63	6·01	6·40	6·80	7·21	7·63	8·07	8·52
5	4·45	4·78	5·13	5·49	5·86	6·24	6·64	7·04	7·46	7·89	8·34	8·80
6	4·67	5·01	5·36	5·72	6·10	6·49	6·89	7·30	7·73	8·17	8·62	9·08
7	4·89	5·24	5·60	5·97	6·35	6·75	7·15	7·57	8·00	8·45	8·91	9·38
8	5·14	5·49	5·85	6·23	6·62	7·02	7·43	7·86	8·30	8·75	9·21	9·68
9	5·38	5·75	6·12	6·50	6·90	7·30	7·72	8·15	8·59	9·05	9·52	10·01
10	5·65	6·02	6·40	6·78	7·19	7·60	8·02	8·46	8·90	9·37	9·85	10·34
11	5·93	6·30	6·68	7·08	7·49	7·91	8·34	8·78	9·23	9·70	10·19	10·69
12	6·21	6·59	6·98	7·38	7·80	8·23	8·67	9·12	9·58	10·05	10·54	11·04
13	6·52	6·91	7·30	7·71	8·13	8·56	9·01	9·46	9·93	10·41	10·91	11·41
14	6·84	7·23	7·63	8·04	8·47	8·91	9·36	9·82	10·30	10·78	11·28	11·80
15	7·17	7·56	7,97	8·39	8·82	9·27	9·72	10·19	10·67	11·17	11·67	12·19
16	7·51	7·91	8·32	8·75	9·19	9·64	10·10	10·57	11·06	11·56	12·07	12·60
17	7·86	8·27	8·69	9·12	9·56	10·02	10·49	10·97	11·46	11·97	12·49	13·02
18	8·22	8·64	9·06	9·50	9·95	10·41	10·89	11·38	11·88	12·39	12·91	13·45
19	8·60	9·02	9·45	9·90	10·35	10·82	11·30	11·80	12·30	12·82	13·35	13·90
20	8·99	9·41	9·85	10·30	10·77	11·24	11·73	12·23	12·74	13·27	13·80	14·35
21	9·39	9·82	10·27	10·72	11·19	11·67	12·17	12·67	13·19	13·72	14·27	14·82
22	9·80	10·24	10·69	11·15	11·63	12·12	12·62	13·13	13·65	14·19	14·74	15·30
23	10·23	10·67	11·13	11·60	12·08	12·57	13·08	13·60	14·13	14·67	15·23	15·80
24	10·67	11·12	11·58	12·06	12·54	13·04	13·56	14·08	14·62	15·17	15.73	16·30
25	11·12	11·57	12·04	12·52	13 02	13·53	14·04	14·57	15·12	15·67	16·24	16·82
26	11·58	12·04	12·52	13·01	13·51	14·02	14·54	15·08	15·63	16·19	16·77	17·35
27	12·06	12·52	13·01	13·50	14·01	14·52	15·06	15·60	16·15	16·72	17·30	17·90
28	12·54	13·02	13·51	14·01	14·52	15·04	15·58	16·13	16·69	17·26	17·85	18·45
29	13·04	13·53	14·02	14·52	15·04	15·57	16·12	16·67	17·24	17·82	18·41	19·02
30	13·56	14·04	14·54	15.06	15·58	16·12	16·67	17·23	17·80	18·39	18·99	19·60
31	14·08	14·57	15·08	15·60	16·13	16·67	17·23	17·80	18·38	18·97	19·57	20·19
32	14·62	15·12	15·63	16·15	16·69	17·24	17·80	18·38	18·96	19·56	20·17	20·80
33	15·17	15·67	16·19	16·72	17·26	17·82	18·39	18·97	19·56	20·17	20·78	21·41
34	15·73	16·24	16·77	17·30	17·85	18·41	18·99	19·57	20·17	20·78	21·41	22·04
35	16·30	16·82	17·35	17·90	18·45	19·02	19·60	20·19	20·80	21·41	22·04	22·69
36	16·89	17·41	17·95	18·50	19·06	19·63	20·22	20·82	21·43	22·05	22·69	23·34
37	17·49	18·02	18·56	19·12	19·68	20·26	20·86	21·46	22·08	22·71	23·35	24·01
38	18·10	18·64	19·19	19·75	20·32	20·91	21·51	22·12	22·74	23·38	24·03	24·69
39	18·72	19·27	19·82	20·39	20·97	21·56	22·17	22·78	23·41	24·06	24·71	25·38
40	19·36	19·91	20·47	21·04	21·63	22·23	22·84	23·46	24·10	24·75	25·41	26·08
41	20·01	20·56	21·13	21·71	22·30	22·91	23·53	24·16	24·80	25.46	26·12	26·80
42	20·67	21·23	21·80	22·39	22·99	23·60	24·22	24·86	25·51	26·17	26·84	27·52
43	21·34	21·91	22·49	23·08	23·69	24·30	24·93	25·57	26·23	26·90	27·57	28·27
44	22·02	22·60	23·19	23·78	24·40	25·02	25·66	26·30	26·96	27·64	28·32	29·02
45	22·72	23·30	23·90	24·50	25·12	25·75	26·39	27·04	27·70	28·39	29·08	29·78
46	23·43	24·02	24·62	25·23	25·85	26·49	27·14	27·80	28·47	29·15	29·85	30·56
47	24·15	24·75	25·35	25·97	26·60	27·24	27·90	28·57	29·24	29·93	30·64	31·35
48	24·89	25·49	26·10	26·72	27·36	28·01	28·67	29·34	30·02	30·72	31·43	32·15
49	25·64	26·24	26·86	27·49	28·13	28·78	29·45	30·13	30·82	31·52	32·24	32·97
50	26·40	27·01	27·63	28·27	28·91	29·57	30·25	30·93	31·63	32·34	33·06	33·80

breadth of base in feet.	BREADTH OF BASE OF CUTTING IN FEET.											
	36	37	38	39	40	41	42	43	44	45	46	47
0	8·00	8·45	8·91	9·39	9·88	10·38	10·89	11·41	11·95	12·50	13·06	13·64
1	8·23	8·69	9·15	9·64	10·13	10·64	11·15	11·69	12·23	12·78	13·35	13·93
2	8·47	8·93	9·41	9·90	10·40	10·91	11·43	11·97	12·52	13·08	13·65	14·24
3	8·72	9·19	9·67	10·17	10·67	11·19	11·72	12·27	12·82	13·39	13·97	14·56
4	8·99	9·46	9·95	10·45	10·96	11·49	12·02	12·57	13·14	13·71	14·30	14·90
5	9·27	9·75	10·24	10·75	11·27	11·80	12·34	12·89	13·46	14·04	14·64	15·24
6	9·56	10·04	10·54	11·05	11·58	12·12	12·67	13·23	13·80	14·39	14·99	15·60
7	9·86	10·35	10·86	11·38	11·91	12·45	13·01	13·57	14·15	14·75	15·36	15·97
8	10·17	10·67	11·18	11·71	12·25	12·80	13·36	13·93	14·52	15·12	15·73	16·35
9	10·50	11·01	11·52	12·06	12·60	13·15	13·72	14·30	14·90	15·50	16·12	16·75
10	10·84	11·35	11·87	12·41	12·96	13·53	14·10	14·69	15·29	15·90	16·53	17·16
11	11·19	11·71	12·24	12·78	13·34	13·91	14·49	15·08	15·69	16·30	16·93	17·58
12	11·55	12·08	12·61	13·16	13·73	14·30	14·89	15·49	16·10	16·72	17·36	18·00
13	11·93	12·46	13·01	13·56	14·13	14·71	15·30	15·91	16·52	17·15	17·80	18·45
14	12·32	12·86	13·41	13·97	14·54	15·13	15·73	16·34	16·96	17·60	18·25	18·91
15	12·72	13·27	13·82	14·39	14·97	15·56	16·17	16·78	17·41	18·06	18·71	19·38
16	13·14	13·69	14·25	14·82	15·41	16·01	16·62	17·24	17·88	18·53	19·19	19·86
17	13·56	14·12	14·69	15·27	15·86	16·46	17·08	17·71	18·35	19·01	19·67	20·35
18	14·00	14·56	15·14	15·72	16·32	16·93	17·56	18·19	18·84	19·50	20·17	20·86
19	14·45	15·02	15·60	16·19	16·80	17·41	18·04	18·69	19·34	20·01	20·69	21·38
20	14·91	15·49	16·07	16·67	17·28	17·91	18·54	19·19	19·85	20·53	21·21	21·91
21	15·39	15·97	16·56	17·17	17·78	18·41	19·06	19·71	20·38	21·06	21·75	22·45
22	15·88	16·46	17·06	17·67	18·30	18·93	19·58	20·24	20·91	21·60	22·30	23·01
23	16·38	16·97	17·57	18·19	18·82	19·46	20·12	20·78	21·46	22·15	22·86	23·57
24	16·89	17·49	18·10	18·72	19·36	20·01	20·67	21·34	22·02	22·72	23·43	24·15
25	17·41	18·02	18·64	19·27	19·91	20·56	21·23	21·91	22·60	23 30	24·02	24·75
26	17·95	18·56	19·19	19·82	20·47	21·13	21·80	22·49	23·19	23·90	24·62	25·35
27	18·50	19·12	19·75	20·39	21·04	21·71	22·39	23·08	23·78	24·50	25·23	25·97
28	19·06	19·68	20·32	20·97	21·63	22·30	22·99	23·69	24·40	25·12	25·85	26·60
29	19·63	20·26	20·91	21·56	22·23	22·91	23·60	24·30	25·02	25·75	26·49	27·24
30	20·22	20·86	21·51	22·17	22·84	23·53	24·22	24·93	25·66	26·39	27·14	27·90
31	20·82	21·46	22·12	22·78	23·46	24·16	24·86	25·57	26·30	27·04	27·80	28·57
32	21·43	22·08	22·74	23·41	24·10	24·80	25·51	26·23	26·96	27·70	28·47	29·24
33	22·05	22·71	23·38	24·06	24·75	25·46	26·17	26·90	27·64	28·39	29·15	29·93
34	22·69	23·35	24·03	24·71	25·41	26·12	26·84	27·57	28·32	29·08	29·85	30·64
35	23·34	24·01	24·69	25·38	26·08	26·80	27·52	28·27	29·02	29·78	30·56	31·35
36	24·00	24·67	25·36	26·06	26·77	27·49	28·22	28·97	29·72	30·50	31·28	32·08
37	24·67	25·35	26·04	26·75	27·46	28·19	28·93	29·69	30·45	31·23	32·02	32·82
38	25·36	26·04	26·74	27·45	28·17	28·91	29·65	30·41	31·19	31·97	32·77	33·57
39	26·06	26·75	27·45	28·17	28·90	29·64	30·39	31·15	31·93	32·72	33·52	34·33
40	26·77	27·46	28·17	28·90	29·63	30·38	31·14	31·91	32·69	33·49	34·30	35·12
41	27·49	28·19	28·91	29·64	30·38	31·13	31·90	32·67	33·46	34·27	35·08	35·91
42	28·22	28·93	29·65	30·39	31·14	31·90	32·67	33·45	34·25	35·06	35·88	36·71
43	28·97	29·69	30·41	31·15	31·91	32·67	33·45	34·24	35·04	35·86	36·69	37·53
44	29·72	30·45	31·19	31·93	32·69	33·46	34·25	35·04	35·85	36·67	37·51	38·35
45	30·50	31·23	31·97	32·72	33·49	34·27	35·06	35·86	36·67	37 50	38·34	39·19
46	31·28	32·02	32·77	33·52	34·30	35·08	35·88	36·69	37·51	38·34	39·19	40·04
47	32·08	32·82	33·57	34·33	35·12	35·91	36·71	37·53	38·35	39·19	40·04	40·91
48	32·89	33·64	34·40	35·16	35·95	36·75	37·56	38·38	39·21	40·06	40·91	41·78
49	33·71	34·46	35·23	36·00	36·80	37·60	38·41	39·24	40·08	40·93	41·80	42·67
50	34·54	35·30	36·07	36·86	37·65	38·46	39·28	40·12	40·96	41·82	42·69	43·57

Base or Sum of Heights	Tabular Number	Base or Sum of Heights	Tabular Number	Base or Sum of Heights	Tabular Number	Base or Sum of Heights	Tabular Number
ft. in.		ft. in.		ft. in.		ft. in.	
3	0·0006	13 0	0·0298	25 6	0·0585	38 0	0·0872
6	0·0011	3	0·0304	9	0·0591	3	0·0878
9	0·0017	6	0·0310			6	0·0884
		9	0·0315	26 0	0·0597	9	0·0889
1 0	0·0023			3	0·0602		
3	0·0029	14 0	0·0321	6	0·0608	39 0	0·0895
6	0·0034	3	0·0327	9	0·0614	3	0·0901
9	0·0040	6	0·0333			6	0·0907
		9	0·0338	27 0	0·0620	9	0·0912
2 0	0·0046			3	0·0625		
3	0·0052	15 0	0·0344	6	0·0631	40 0	0·0918
6	0·0058	3	0·0350	9	0·0637	3	0·0924
9	0·0063	6	0·0356			6	0·0930
		9	0·0361	28 0	0·0643	9	0·0935
3 0	0·0069			3	0·0648		
3	0·0075	16 0	0·0367	6	0·0654	41 0	0·0941
6	0·0080	3	0·0373	9	0·0659	3	0·0947
9	0·0086	6	0·0379			6	0·0953
		9	0·0384	29 0	0·0665	9	0·0958
4 0	0·0092			3	0·0671		
3	0·0098	17 0	0·0390	6	0·0677	42 0	0·0964
6	0·0103	3	0·0396	9	0·0682	3	0·0970
9	0·0109	6	0·0402			6	0·0976
		9	0·0407	30 0	0·0688	9	0·0981
5 0	0·0115			3	0·0694		
3	0·0120	18 0	0·0413	6	0·0700	43 0	0·0987
6	0·0126	3	0·0419	9	0·0705	3	0·0993
9	0·0132	6	0·0425			6	0·0999
		9	0·0430	31 0	0·0711	9	0·1004
6 0	0·0138			3	0·0717		
3	0·0143	19 0	0·0436	6	0·0723	44 0	0·1010
6	0·0149	3	0·0442	9	0·0728	3	0·1016
9	0·0155	6	0·0448			6	0·1022
		9	0·0453	32 0	0·0734	9	0·1027
7 0	0·0161			3	0·0740		
3	0·0166	20 0	0·0459	6	0·0746	45 0	0·1033
6	0·0172	3	0·0465	9	0·0751	3	0·1039
9	0·0178	6	0·0471			6	0·1045
		9	0·0476	33 0	0·0757	9	0·1050
8 0	0·0184			3	0·0763		
3	0·0189	21 0	0·0482	6	0·0769	46 0	0·1056
6	0·0194	3	0·0488	9	0·0774	3	0·1062
9	0·0200	6	0·0494			6	0·1068
		9	0·0499	34 0	0·0780	9	0·1073
9 0	0·0207			3	0·0786		
3	0·0212	22 0	0·0505	6	0·0792	47 0	0·1079
6	0·0217	3	0·0511	9	0·0797	3	0·1085
9	0·0223	6	0·0517			6	0·1091
		9	0·0522	35 0	0·0803	9	0·1096
10 0	0·0230			3	0·0809		
3	0·0235	23 0	0·0528	6	0·0815	48 0	0·1102
6	0·0241	3	0·0534	9	0·0820	3	0·1108
9	0·0246	6	0·0540	36 0	0·0826	6	0·1114
		9	0·0545	3	0·0832	9	0·1119
11 0	0·0252			6	0·0838		
3	0·0258	24 0	0·0551	9	0·0843	49 0	0·1125
6	0·0263	3	0·0557			3	0·1130
9	0·0269	6	0·0562	37 0	0·0849	6	0·1136
		9	0·0568	3	0·0855	9	0·1141
12 0	0·0275			6	0·0861		
3	0·0281	25 0	0·0574	9	0·0866	50 0	0·1147
6	0·0287	3	0·0579				
9	0·0292						

Base or Sum of Heights	Tabular Number	Base or Sum of Heights	Tabular Number	Base or Sum of Heights	Tabular Number	Base or Sum of Heights	Tabular Number
ft. in.		ft. in.		ft. in.		ft in	
3	0·0004	13 0	0·0184	25 6	0·0362	38 0	0·0538
6	0·0007	3	0·0188	9	0·0365	3	0·0542
9	0·0011	6	0·0191			6	0·0545
		9	0·0195	26 0	0·0368	9	0·0549
1 0	0·0014			3	0·0372		
3	0·0018	14 0	0·0198	6	0·0375	39 0	0·0553
6	0·0021	3	0·0202	9	0·0379	3	0·0556
9	0·0025	6	0·0206			6	0·0560
		9	0·0209	27 0	0·0383	9	0·0564
2 0	0·0028			3	0·0386		
3	0·0032	15 0	0·0213	6	0·0389	40 0	0·0567
6	0·0035	3	0·0216	9	0·0393	3	0·0571
9	0·0039	6	0·0220			6	0·0574
		9	0·0223	28 0	0·0397	9	0·0578
3 0	0·0043			3	0·0401		
3	0·0047	16 0	0·0227	6	0·0404	41 0	0·0581
6	0·0050	3	0·0230	9	0·0408	3	0·0585
9	0·0054	6	0·0233			6	0·0588
		9	0·0237	29 0	0·0411	9	0·0592
4 0	0·0057			3	0·0415		
3	0·0061	17 0	0·0241	6	0·0418	42 0	0·0595
6	0·0064	3	0·0245	9	0·0422	3	0·0599
9	0·0068	6	0·0249			6	0·0602
		9	0·0252	30 0	0·0425	9	0·0606
5 0	0·0071			3	0·0429		
3	0·0075	18 0	0·0255	6	0·0432	43 0	0·0609
6	0·0078	3	0·0260	9	0·0436	3	0·0613
9	0·0082	6	0·0263			6	0·0617
		9	0·0267	31 0	0·0439	9	0·0620
6 0	0·0085			3	0·0443		
3	0·0089	19 0	0·0269	6	0·0446	44 0	0·0624
6	0·0092	3	0·0273	9	0·0450	3	0·0627
9	0·0096	6	0·0277			6	0·0630
		9	0·0280	32 0	0·0453	9	0·0634
7 0	0·0099			3	0·0457		
3	0·0103	20 0	0·0283	6	0·0460	45 0	0·0638
6	0·0106	3	0·0287	9	0·0464	3	0·0642
9	0·0110	6	0·0291			6	0·0645
		9	0·0294	33 0	0·0468	9	0·0648
8 0	0·0113			3	0·0471		
3	0·0118	21 0	0·0298	6	0·0475	46 0	0·0652
6	0·0121	3	0·0301	9	0·0478	3	0·0655
9	0·0125	6	0·0305			6	0·0659
		9	0·0308	34 0	0·0482	9	0·0663
9 0	0·0128			3	0·0486		
3	0·0132	22 0	0·0312	6	0·0489	47 0	0·0666
6	0·0135	3	0·0315	9	0·0493	3	0·0670
9	0·0139	6	0·0318			6	0·0673
		9	0·0322	35 0	0·0496	9	0·0677
10 0	0·0142			3	0·0500		
3	0·0146	23 0	0·0326	6	0·0503	48 0	0·0680
6	0·0149	3	0·0330	9	0·0507	3	0·0684
9	0·0153	6	0·0333			6	0·0687
		9	0·0337	36 0	0·0510	9	0·0691
11 0	0·0156			3	0·0514		
3	0·0160	24 0	0·0340	6	0·0517	49 0	0·0694
6	0·0163	3	0·0344	9	0·0521	3	0·0698
9	0·0167	6	0·0347			6	0·0701
		9	0.0351	37 0	0·0524	9	0·0705
12 0	0·0170			3	0·0528		
3	0·0174	25 0	0·0354	6	0·0531	50 0	0·0708
6	0·0177	3	0·0358	9	0·0535		
9	0·0181						

INTRODUCTION.

In the Cuttings or Embankments for Railways, Canals, or Common Roads, the Prismoid is that solid which is applicable to the form cut out in hills, or filled into hollows, in the line where the road is made.

The Rule for finding the solidity of a Prismoid will be found in the description of Table I.

Where there is a long line of road to be estimated, the calculation of it in so many Prismoids as must be made in the most favourable ground, is tedious: hence several forms of tables have been invented and used, to render the calculation in extensive works shorter and easier.

It is not thought desirable here to enter upon a critical examination of the tables already published on this subject, so as to point out the individual defects or merits of each; neither is the author inclined to conjure up false, or common methods, as they are called, which were never found in any mathematical work, and exhibit them, to show the superiority of a true method—the tables he has put forward it is hoped will be found satisfactory, and that is his great object.

In selecting a Form for the principal Table, so as to embody the greatest convenience in the least space, regard was had chiefly to keeping the required parts on one page, so far as is practicable, so that the operator should not be obliged to turn over to other pages for the numbers he requires. Thus, every ordinary slope, in rock or earthwork, is contained in one double page as the book lies open, for 50 feet depth of cutting at intervals of 3 inches, for 20 and 30 feet bases, and with a few more figures of calculation, for every possible breadth of base.

The rule that will be given for working out by this table, will require a few figures of calculation in making out the slopes more than might be required by other forms of table:—thus, the content of a foot or a yard in length of the section might be found in a table with two dimensions of heights, one forming a column down at the left hand margin of the page, the other across at the top, as headings; but to do this as fully as can be done by the present Table II, limiting the bases to a range from 10 to 50 feet, and the heights and slopes as given therein, would require so enormous an extension of the table in this form, that 43,200 pages would be necessary to comprise what is done here in 24 pages; otherwise some breadth of base, some slope, or some interval of height must be omitted, which is included in the form adopted here.

The intervals of height selected are 3 inches; although one foot is the smallest interval of height required by the standing orders of the House of Commons on parliamentary sections; yet this is considered too wide an interval for accuracy in practical work, especially where rock occurs, or

where disputes might arise between companies and their contractors. Suppose the piece of cutting marked No 2, Plate 1, Fig 1, where the heights given are 35 feet 6 inches, and 45 feet 6 inches, length 100 feet, and side slopes 1½ to 1 :—In those tables which have intervals of whole feet, a number must be taken out either 6 inches above or below the true height—if taken at the foot above, the content is 13941 cube yards ; if taken at the foot below, the content is 13380 cube yards, whereas the true content is 13660 cube yards, giving an error of 280 cube yards in 13660 ; or about one forty-eighth part of the whole.

The surveyor in taking his levels, enters them as they occur to him, in feet and hundredths, or in feet and inches ; the notes are thus taken to a great degree of accuracy, which is quite necessary for carrying on the section. This degree of accuracy is rendered useless, so far as the calculation of quantity is concerned, by adopting intervals of whole feet in the heights.

On the other hand, in some tables the intervals of height are one-twentieth of a foot, and this is thought to be an affectation of accuracy which can never be attained in practice. Every surveyor knows that in the most even natural surface of ground, when he has his staff placed on the surface, it requires a nice eye to tell, in a cross section, whether he be within an inch of the true point or not ; and the case becomes worse when the intervals between the heights are taken, as in some tables, at whole chains, or as in others, at 100 feet asunder ; and yet this inch is nearly double the intervals of height given in the tables alluded to.

Here in one case there is too little accuracy, in the other, too much ; and to avoid both, intervals of 3 inches, or ¼ of a foot, are adopted in this table, as before stated.

With regard to the intervals for the length—some have chosen in their tables 100 feet ; others have adopted whole chains or 66 feet ; either of these may be used advantageously, where the natural surface of the ground is very even ; in surveying over rock or uneven ground, however, it is found that no attention can be paid to regular intervals of this kind, and tables calculated for such intervals become troublesome to manage, when the intervals on the section are different from those in the tables, which is very often the case. For these reasons, a length on the section of one foot is the interval chosen in this table, and this answers for all lengths of interval between the given transverse sections, as will be shown in the rule for using the tables, and the examples attached.

There is also this advantage in following this form, that in every interval between the sections, the quantity of that interval is found in itself, and this is useful in arranging the Leads ; so that, as far as is practicable, the quantity of cutting may be enough to fill the embankments and not more ; or, if on trial they are found otherwise, that a correction of the gradients may be made to effect that object. This will be found especially useful in cutting through rock, and could not be done by tables adapted to equal intervals of one chain, of 100 feet, or any other.

Where, however, the ground is favourable, the adoption of equal intervals, especially that of 100 feet, is very desirable ; it makes a great short cut in the calculations of the earthwork ; but for this purpose the surveyor should use a chain of either 50 or 100 feet long, and made with links each a foot in length—such a chain is perhaps the best for road or canal surveying.

DESCRIPTION AND USE

OF THE

TABLES.

TABLE I.

This is a very general Table, and can be used for all varieties and dimensions of the Prismoid. It consists of two pages only, and the heights are carried up to 100 feet in intervals of 3 inches. There is but one tabular number, but this can be used either for Cores or Slopes, according to the rule given. There is a little more trouble in calculating with it than with Table II., which being considered the principal Table will be described before it.

TABLE II.

This is the chief Table for the calculation of Earthwork:

It is the same in principle as Table I., but extended and rendered more useful, by having the tabular numbers calculated more near the result required.

It is made out for all the usual slopes in Earthwork, from ¼ to 1, to 3 to 1, being 12 different slopes increasing by quarters, having a double page for each.

It consists of 5 columns; the first is for the heights, in intervals of 3 inches; the second, third, and fourth, are for the Cores or those parts that stand vertically over or under the bases, of 1, 20, and 30 feet respectively; the fifth column is for the side slopes.

The 30 feet base column is considered the principal of the core columns, that being the breadth usually adopted in roads for a double line of rails, and which was selected especially by the Irish Railway Commissioners, as the breadth for their railroads.

The column for a 20 feet base is added, this being sometimes the breadth

chosen for a single line of railroad, or a country road. But besides this, this column is useful in checking the calculation of other work, and for this purpose chiefly it has got a place here. Thus, if the cutting in a line of 30 feet base be all calculated by one person and in one way directly from the tables, the same may be done another way, by using the 20 feet column and adding the number corresponding to 10 feet more of breadth, which may be found by adding half the number in the 20 feet column to itself.

The column for 1 foot breadth of base is put in the same page, for the purpose of suiting the table to any breadth of road, so that the calculator having the page for his side slopes open before him, need not turn over to any other table to complete his work, as will be shewn presently.

The calculation of the Core is independent of the slopes; and that of the slopes is the same whatever be the breadth of base.

RULE FOR USING TABLE II.

Having found the page headed by the given slope.

1. In the column answering to the breadth of Base, find the Tabular Number which is opposite the average Height—
2. Find the Tabular Number in the Slope column corresponding to either of the Heights, and multiply this by the other height—
3. Find the Tabular Number corresponding to the difference of the Heights, and Multiply it by one-third of the same difference—
4. Add those three results so obtained, and multiply their sum by the length in feet—the Product is the content of the Cutting or Embankment in cube yards.

EXAMPLE.

Required the quantity of cutting in an excavation, the base being 30 feet, and the side Slopes $1\frac{1}{2}$ to 1, the other dimensions as shown in the Section, Plate I, Fig. 1.

FORM FOR ENTERING THE DIMENSIONS FOR CALCULATION.

	Interval of length.	Heights	Tabular Numbers	Results.	Cube Yards
1	60	0:0 35:6	19·722 — — … $1{\cdot}972 \times \frac{35\frac{1}{2}}{3}$	19·722 … 23·335 $43{\cdot}057 \times 60$	2583
2	100	35:6 45:6	45·000 — — $2{\cdot}528 \times 35\frac{1}{2}$ $0{\cdot}556 \times \frac{10}{3}$	45·000 89·744 1·853 $136{\cdot}597 \times 100$	13660
3	200	45:6 0:0	25·278 — — … $2{\cdot}528 \times \frac{45\frac{1}{2}}{3}$	25·278 … 38·341 $63{\cdot}619 \times 200$	12724
			Total of Cutting—Cube Yards,		28967

In the foregoing Example, having entered the distances and heights in their respective columns, open the page for Slope 1½ to 1, and the first tabular number to be found is that answering to 17 feet 9 inches, the mean height, in the column headed Base 30 Feet. This number 19·722 is entered in the 4th column or that of Tabular Numbers, as also in the 5th, or Results. Since one of the heights is 0, the second part of the rule gives a result of 0, and therefore a dotted line is put in the space. The Tabular Number corresponding to the difference of heights 35 feet 6 inches in the column for slopes is 1·972; this is entered next, to be multiplied by one-third of the same difference; the product 23·335 is entered in the fifth column. The sum of these two, 43·057 is then multiplied by the distance between the sections—60 feet, and the product 2583, which is the content in cube yards of the first division, is entered in the sixth column.

The next Tabular Number is taken from the 30 Feet Base column opposite the average height 40 feet 6 inches, and is 45·000: it is entered in the fourth and fifth columns. Opposite 45 feet 6 inches, one of the heights in the column for slopes, is 2·528; this is to be multiplied by 35½, the height at the other end of the cutting: the product 89·744 is placed in the fifth column. Opposite 10 feet the difference of the heights, in the same column is 0·556; this is entered, and multiplied by one-third of the same difference, and the product 1·853 is placed in the fifth column. The three results now in the fifth column are added together, making 136·597; and multiplied by 100 the length, the product is the content of the second division of the cutting—13660 cube yards.

The Tabular Number for the average height of the third division 22 feet 9 inches, as also taken from the 30 feet column, is 25·278; this as before is entered in the fourth and fifth columns. The result of the second part of the rule will be 0, in this as well as in the first division of the cutting. The tabular number for 45 ft. 6 in., the difference of the heights, is found in the column of slopes to be 2·528; it is multiplied by one-third of the same difference, and the product 38·341 is entered in the fifth column to be added to 25·278; the sum 63·619 is multiplied by 200 the length, and the product 12724 cube yards entered in the content column—being the quantity contained in the third division of the section.

By adding this to the two former contents, the total quantity of cutting in the section is found to be 28967 cube yards.

This has been calculated at length, by the formula (in page 49), and found to be 28966·5 cube yards, or half a cube yard less; an error accounted for by carrying the decimals in the table to only three places.

It may be here remarked, that the first result in the calculation of each division is the number of cube yards for a foot in length of the core; and the sum of the other two results is the content of the slopes for a foot in length.

When the required dimensions are not found in the Table, or when the base is neither 20 nor 30 feet wide—

1. Suppose the number corresponding to a base of 26 feet be required, it may be done three ways:—1. As above—Multiply the number opposite the given height in the 1 foot column by 26; or 2.—Multiply the same number by 6, and add the product to the number for 20 feet; or 3.—Multiply the same number

by 4, and take the product from the number in the 30 feet column—any of these three will give the same result. This is for the Core only.

2. When the average height of a cutting or embankment exceeds 50 feet, its tabular number for the core will be equal to twice the tabular number for half that height; or in this case, instead of entering the table with the height, it may be entered with the base, and the corresponding number multiplied by the average height.

3. For the Slopes—When both heights exceed 50 feet, half one height and double the other will give the same result and bring the dimensions within the limits of the Table. Or, take a third of one height and three times the other, &c. This does not apply to the core, which is based upon the average heights.

4. When the given ratio of the slopes exceeds 3 to 1, the calculations may be made with a slope of 1 to 1, taking care to multiply the results of the second and third parts of the Rule by the given ratio, before entering them in the result column: or, one-half or one-third the given ratio may be substituted, and the result doubled or trebled before being placed in its proper column.

5. When the slopes on both sides of a cutting or embankment are different, take the mean or average of the two ratios of the slopes, and proceed with this as if both sides were so sloped alike. This and the preceding remark apply also to Table I.

The following Example illustrates the first, fourth, and fifth of these observations:—

Required the quantity of earthwork in a sea Embankment, 100 feet in length and 10 feet broad at top; the height, 12 feet at each end, and the sides sloping 1 in 8 next the sea, and 1 in 2 next the land, agreeably to the Section shewn in Plate 1., Fig. 3.

Length.	Heights.	Tabular Numbers.	Results.	
100	12	4·444 —	4·444	
	12	1·111×12×2	26·664	
		...	...	
			31·108	×100=3110·8 cube yards

The length and heights being entered—opposite the average height 12 feet, in the 20 feet column is 8·889, the half of which is 4·444, which is placed in the third and also in the result column. The average of the two side Slopes, 8 to 1 and 2 to 1, is 5 to 1; but as this is not in the Table, take from Slope 2½ to 1 the number 1·111 opposite 12 feet one of the heights, and enter it in the third column, to be multiplied by 12 feet the other height, and by 2 in order to bring the result to an average Slope of 5 to 1. Had the Tabular number been taken from the 1 to 1 Slope column, a multiplier of 5 should be used instead of 2. The result of the third part of the rule will be 0 because there is no difference of heights, as both ends are alike. Then the sum of the two results is 31·108, which multiplied by the length 100 feet, gives a content of 3110·8 cube yards.

The true content of this is 3111 cube yards, the small error of one-fifth of a cube yard, arising from the Table having been carried to only 3 places of decimals.

TABLE I.

This Table is very general, and is applicable to Prismoids of any dimensions. It answers for every Slope, for every Breadth of Road or Base, for every Height, and for every Length of Interval.

The usual rule for obtaining the content of a Prismoid as stated by Bonnycastle, is—

> "To the sum of the areas of the two ends, add four times the area of a section parallel to the two ends and equally distant from them, and this sum being multiplied by one-sixth of the length, will give the solid content of the prismoid."

This rule though concise in the enunciation, is tedious in its application, and is not stated in terms of the given dimensions. The following Rule, though seemingly longer, requires fewer figures, and is more explicit—

Rule for the Content of a Prismoid.

1. Multiply the breadth of the base by half the sum of the end heights—
2. Multiply together the two end heights, and the product by the ratio of the side slopes—
3. Square the difference of the end heights, take one-third of that square and multiply it by the ratio of the side slopes—
4. Add into one sum the three Results so found, and multiply it by the length: The product is the cubic content in the same denomination as the given dimensions—

This should not perhaps be the place to introduce a rule in mensuration, even though a new one, but this rule accords with the tables, all being derived from the same formula, and depending on the same subdivision of the prismoid. An operation has been performed by both rules from the following dimensions:—Suppose a piece of earthwork 200 feet long, 36 feet breadth of base, side slope $2\frac{1}{2}$ to 1, heights at the ends, 15 feet 6 inches and 19 feet respectively. The calculation of this by the first rule requires 191 figures, by the second rule 131; thus shewing that the working out by the new rule saves one-third of the Figures.

This rule is derived from the following general expression for the content of a prismoid:—

$$L.\left\{B\frac{H+h}{2}+S\,h\,H+S\frac{d^2}{3}\right\}^{*}$$

where L and B represent its length and breadth of base respectively; H and h, the end heights; d, the difference of those heights; and S, the ratio of the side slopes.

The whole of the dimensions being given in feet, this expression when divided by 27 to reduce the result to cube yards, becomes

$$L.\left\{B\frac{\frac{1}{2}(H+h)}{27}+Sh\frac{H}{27}+S\frac{d}{3}\cdot\frac{d}{27}\right\}$$

---

* The above formula is thus demonstrated:—(Plate 1. Fig 2.)

Let D A C O and F A C E represent the sections at the opposite ends of a cutting—draw A N, C I, F P, and E R, at right angles to A C. Four vertical planes passing longitudinally through these lines, will divide the solid into five parts, viz—

1. The core, or part that stands upon the base, bounded by vertical planes at the sides and ends, as A C I N—this is a Prism.

2 & 3. The adjoining portions of the slopes:—one, included between the two vertical planes passing through C I and R E, and bounded at the ends by the planes C I R E and C K E, which also are vertical—the other, a similar figure at the opposite side of the core: Each of these is composed of a prism C K E, and a wedge K I R E.

4 & 5. The remainder of the slopes, forming two equal pyramids, having for bases the

To construct a table from this formula requires only to divide a series of numbers by 27; the quotients so obtained will represent the last, or indeed any factor, of each term in the above expression; and we may denominate the first series of figures as Heights or Depths, Average Heights, Difference of Heights, Bases, or Slopes; the annexed tabular numbers being treated accordingly in each case. The term Heights in the table has been adopted as being most general.

The form of table selected having but one tabular number for each height, the whole has been comprised in one page, including a range of heights up to 100 feet, in intervals of three inches, which is considered quite sufficient for every practical purpose.

The first column shews the heights of cutting or embankment, and the second the corresponding tabular number. The first column is continued in the third, fifth, and seventh, &c; and the second, in the fourth, sixth, eighth, &c.

The quantity of cutting or filling in any piece of earthwork of prismoidal form, may be obtained by the table, by attending to the following rule, which consists of four parts, referring to the three members of the above formula, and to the length, which is a common multiplier for each.—

RULE FOR USING TABLE I.

1. Multiply the Tabular Number opposite the average height, by the breadth of the Base.
2. Multiply the Tabular Number opposite either of the heights, by the other height, and the product by the ratio of the Side Slopes.
3. Multiply the Tabular Number opposite the difference of the heights by one-third of that difference, and by the ratio of the Side Slopes.
4. Add the three results so obtained, and multiply their sum by the length in feet; the product is the content of the Cutting or Embankment in cube yards.

---

triangles F P D and E R O, and terminating at the opposite end of the cutting or embankment in F and E, the points of intersection of the ground and side slopes.

The content of the first division or core

$$\therefore A\ C\frac{C\ I+C\ K}{2}\times \text{Length}=B\frac{H+h}{2}\times L \qquad (1)$$

The content of the 2d and 3d divisions

$$=2\left\{\frac{K\ R}{2}+C\ K\ E\right\}\times L$$

$$\text{But } 2\left\{\frac{K\ R}{2}+C\ K\ E\right\}=K\ R+K\ Q=I\ Q=K\ E\times C\ I=S\ h\ H$$

The content therefore is $=S\ h\ H\times L \qquad (2)$

The content of the remaining pyramids

$$=2.\ E\ R\ O\times\frac{L}{3}=R\ V\times\frac{L}{3}=R\ E.\ R\ O\times\frac{L}{3}=d.\ d\ S\times\frac{L}{3}=S\frac{d^2}{3}\times L, \qquad (3)$$

The sum of these three expressions is then equal to the whole content of the prismoid

$$=L.\left\{B\frac{H+h}{2}+S\ h\ H+S\frac{d^2}{3}\right\}$$

The formula and rule apply equally to cuttings and to embankments.

EXAMPLE.

Required the content of the Cutting and Embankment, the longitudinal section and dimensions of which are represented in Plate 1, Fig. 1; the base in the Cutting being 30 feet wide, and the Slopes $1\frac{1}{2}$ to 1; the top of the embankment to be 36 feet wide, and the Side Slopes 2 to 1.

FORM FOR THE CALCULATION.

CUTTING, Base 30 feet, Slopes $1\frac{1}{2}$ to 1.

No of Division	Length	Heights	Tabular Numbers	Results	Content in Cube Yards
1	60:0	0:0 35:6	$0{\cdot}657 \times 30 =$ ... $1{\cdot}315 \times \frac{35\frac{1}{2}}{3} \times 1\frac{1}{2} =$	19·710 ... 23·341	
				43·051 × 60 =	2583
2	100	35:6 45:6	$1{\cdot}500 \times 30 =$ $1{\cdot}315 \times 45\frac{1}{2} \times 1\frac{1}{2} =$ $0{\cdot}370 \times \frac{10}{3} \times 1\frac{1}{2} =$	45·000 89·748 1·850	
				136·598 × 100 =	13660
3	200	45:6 0:0	$0{\cdot}843 \times 30 =$ ... $1{\cdot}685 \times \frac{45\frac{1}{2}}{3} \times 1\frac{1}{2} =$	25·290 ... 38·333	
				63·623 × 200 =	12724
				Total Cutting	28967

EMBANKMENT, top 36 feet wide, Slopes 2 to 1.

4	85	0:0 30:6	$0{\cdot}565 \times 36 =$ ... $1{\cdot}130 \times \frac{30\frac{1}{2}}{3} \times 2 =$	20·340 ... 22·976	
				43·316 × 85 =	3682
5	115	30:6 60:6	$1{\cdot}685 \times 36 =$ $1{\cdot}130 \times 60\frac{1}{2} \times 2 =$ $1{\cdot}111 \times \frac{30}{3} \times 2 =$	60·660 136·730 22·220	
				219·610 × 115 =	25255
6	35	60:6 55:0	$2{\cdot}139 \times 36 =$ $2{\cdot}241 \times 55 \times 2 =$ $0{\cdot}204 \times \frac{5\frac{1}{2}}{3} \times 2 =$	77·004 246·510 0·748	
				324·262 × 35 =	11349
7	145	55:0 0:0	$1{\cdot}019 \times 36 =$ ... $2{\cdot}037 \times \frac{55}{3} \times 2 =$	36·684 ... 74·690	
				111·374 × 145 =	16149
				Total Filling	56435

In proceeding with the above form, the number of the Division of Cutting is put in the first column, the length of the interval between the Sections in the second, and in the third are put the Heights at the ends of the division.

The average of the two first heights is 17 feet 9 inches, and its corresponding tabular number is 0·657; which enter in the fourth column, to be multiplied by 30, the breadth of the base. In this case, since one of the heights is 0 : 0, the result of the second part of the rule would be 0, and it is in the proper place represented by a dotted line. The difference of the heights is 35 feet 6 inches, and the corresponding tabular number to this is 1·315; which is entered in its place to be multiplied by 35½, and by the ratio of the slope 1½, and by one-third. The sum of these two results is 43·051, which multiplied by the length in feet, gives 2583 cube yards, which is entered in the sixth column—being the content of the first division of the section.

For the Second Division.—The tabular number opposite the average height 40 feet 6 inches is entered, to be multiplied by 30, the breadth of the base. The number corresponding with 35 feet 6 inches is 1·315, and is also to be entered in its place and multiplied by 45½ and by 1½. The difference of these heights is 10 feet, and its tabular number is 0·370, which is entered, multiplied by 10, by 1½, and by ⅓. These three results added make 136·598, which multiplied by 100, gives 13660 cubic yards for the content of this division.

For the Third Division.—22 feet 9 inches is the mean height, its tabular number is 0·843, which is entered in the fourth column, and multiplied by 30, giving a result of 25·290. Applying the second part of the rule here, the result is 0, which is represented by a dotted line, as in the first division. The difference of the heights is 45 feet 6 inches, its tabular number is 1·685; this is multiplied by one-third of 45½, and that by 1½, the ratio of the slopes—the result is 38·333. This added to the former 25·290, makes 63·623, which multiplied by the length 200 feet, gives 12724 cube yards as the content of the third division. The three divisions added together make 28967 cube yards, the total content of the Cutting.

The true content by the formula is 28966 cube yards, there being an error of 1 cube yard in this quantity, which is caused by carrying the decimals to only three places.

For the Embankment;—in order to vary the breadth of base, or rather in this case the width at top, this is taken at 36 feet, and the Slopes at 2 to 1.

The mode of proceeding is precisely the same as that just described, and it is considered unnecessary to repeat the instructions.

The Example for the Embankment is worked out at full length, in strict accordance with the rule; and an inspection of the tabular numbers, showing what they are multiplied by, &c, &c, it is hoped, will be found sufficient for understanding this part of the calculation.

The preceding example may be made out from the table in a variety of ways. Another form of calculation is added, in which tabular numbers for different members of the dimensions are used. The three first divisions of the section, Plate 1. Fig 1., will be sufficient to illustrate this.

SECOND FORM.

No of Division.	Length.	Heights	Tabular Numbers.	Results.	Content in cubic Yards
1	60·0	0 : 0 35 : 6	$\left\{\begin{array}{l}1\cdot111\times17\frac{3}{4}\\ \cdots\\ 1\cdot315\times\frac{35\frac{1}{2}}{3}\times1\frac{1}{2}\end{array}\right.$	19·720 … 23·341 43·061 × 60 =	2584
2	100 : 0	35 : 6 45 : 6	$\left\{\begin{array}{l}1\cdot111\times40\frac{1}{2}\\ 1\cdot685\times35\frac{1}{2}\times1\frac{1}{2}\\ 0\cdot370\times\frac{10}{3}\times1\frac{1}{2}\end{array}\right.$	44·995 89·725 1·850 136·570 × 100 =	13657
3	200 : 0	45 : 6 0 : 0	$\left\{\begin{array}{l}1\cdot111\times22\frac{3}{4}\\ \cdots\\ 1\cdot685\times\frac{45\frac{1}{2}}{3}\times1\frac{1}{2}\end{array}\right.$	25·275 … 38·333 63·608 × 200 =	12722
				Total Content	28963

The first column contains the number of the division, as before; the second contains the lengths between the sections, also as in the former example; in the third column are entered the heights corresponding to the several lengths against which they are placed.

The tabular number for 30 feet the breadth of base is 1·111, and this is inserted in the 4th column, to be multiplied by the average height 17 ft 9 in., according to the first part of the rule. The product as entered in the result column is 19.720. This method of referring to the table is intended to shew, that it may be entered either with the base or the average height. If the tabular number taken out be for the height, it is to be multiplied by the base for the result; if the tabular number be taken out for the base, it is to be multiplied by the average height, as in this case. This remark applies to the core only, and not to the slopes.

In this as well as in the first form of calculation, the application of the second part of the rule will give a result of 0, since one of the heights is 0, and is therefore represented by a dotted line. The next result 23·341, is obtained in exactly the same manner as in the preceding form. The sum of the two results when multiplied by the length 60 feet, gives the content 2584 cubic yards.

For the second division, the tabular number again for 30 feet is 1·111. It is multiplied by $40\frac{1}{2}$ feet the average height, giving a result of 44·995. The tabular number for $45\frac{1}{2}$ feet one of the heights, is now sought instead of that for $35\frac{1}{2}$, as in the first method of calculation. It is multiplied by $35\frac{1}{2}$ the other height, and by $1\frac{1}{2}$ the ratio of the slopes, giving a result of 89·725. The next result 1·850 is obtained as in the former instance, by finding the tabular number corresponding to the difference of the heights, 10 feet, which is 0·370; and multiplying it by one-third of that difference, and by the ratio of the slopes, $1\frac{1}{2}$. Add these three results, which makes 136·570, and multiply their sum by the length 100 feet; the product, 13657 cube yards, is the content of the second division.

In the third division, the tabular number for 30 is multiplied as before, by the average height, which is here 22¾ feet, giving a product of 25.275. The second part of the rule gives a result of 0 as in the first division, which is represented by a dotted line. Again the tabular number for 45½ feet is 1·685, which multiplied by one-third of 45½, and by 1½, gives a result of 38·333; and this added to the former, makes 63·608, which multiplied by 200, gives 12722 cube yards, the content of the third division.

The total content by this method of calculation is 28963 cube yards, being within 3 yards of the true content.

The example might be calculated by a third method—by entering the table for the second and third results of each division, with the given ratio of slope instead of the heights; but this method is objectionable, inasmuch as the small tabular number corresponding to the given ratio of slope, will give an incorrect result when multiplied by the product of the heights, or by the square of their difference, owing to the want of a sufficient number of places of decimals for this purpose. As a general rule, the number taken out of the table should be that corresponding to the greatest dimension.

In the foregoing forms of calculation it may be seen, that although in each case different tabular numbers are used and multiplied in each form by other members of the dimensions, still the results and the contents of each division are always the same.

TABLE III.

As in Table II. there are bases given of only 30 feet, 20 feet, and 1 foot, this table is introduced to suit every breadth of base when used with that one. It is calculated in columns for breadths from 1 to 10 feet on the core only, or that part which stands vertically over or under the roadway, and does not include the slopes.

Thus, suppose a Roadway 28 feet wide, with side Slopes 1½ to 1; Heights at the ends, 19 feet 6 inches and 29 feet 6 inches respectively; and Length 100 feet—Required the content:

Opposite 24 feet 6 inches, the mean height in the 20 feet column, is 18·148
Opposite same height, in 8 feet column of Table III. is ... ... 7·259

Tabular Number for 28 feet base, 24 feet 6 inches average height 25·407

Or thus;—Opposite 24 feet 6 inches, in the 30 feet column 27·222
Deduct the number opposite same height in the 2 feet column of Table III., ... 1·815

25·407

Length.	Heights.	Tabular Numbers.	Results.	
100	19:6 29:6	25·407 1·639 × 19½ 0·556 × 10/3	25·407 31·960 1·853	
			59·220	× 100 = 5922 Cube Yards

Either of the above methods produces the same Tabular Number 25·407

for 28 feet base, and 24 feet 6 inches average height; and this method affords the advantage of calculating quantities by two different ways, as a check, which may be done with much convenience for any breadth of roadway between 20 and 30 feet, from having the columns so headed together on the same page, as in Table II. If a base of 56 feet be required—add the Tabular Numbers in the 30 and 20 feet columns of Table II. to that in the 6 feet column in Table III.; this gives the Tabular Number for the core for a 56 feet base —all, it must be observed, for the same average height.

Suppose the average height 25 feet 6 inches, and Slope 2 to 1.—

In the page headed Slope 2 to 1, opposite 25 feet 6 inches in the 20 feet column is	18·889
In same page, in the 30 feet column	28·333
In the 6 feet column of Table III, opposite 25 feet 6 inches	5·667
Tabular Number for 56 ft. base & 25 ft. 6 in. average height	52·889

But where a peculiar breadth of roadway is adopted, the best way for the Engineer would be, to calculate a column for that breadth, which might be written on a narrow slip of paper and laid over either the 20 or 30 feet column of Table II, where it could be used with the Heights and Slopes of the Table.

TABLE IV.

Where the ground through which a roadway passes is higher on one side than on the other, or slopes transversely, the quantity of cutting is *greater* than the content as found by tables calculated for ground which is level across.

In Plate I. Fig 4—Let A E represent the surface of the ground, and A C D E the Section of a Cutting to be made therein. Bisect the base C D in I, and draw I F perpendicular to it; and through F the point of intersection with the ground surface and the point also at which the level is supposed to have been taken, draw the horizontal line O K, which of course will be parallel to the base C D; draw also O R parallel to D K, and D N perpendicular to C D. The Figure O C D K is that which is found calculated in Tables as the Cross Section; whereas A C D E is the true section. The two triangles F O R and F E K are equiangular, and have the sides O F and F K equal, the triangles are therefore equal; then the whole triangle A O F above the line O K is greater than F E K below it, by the triangle R O A, which may be called here the triangle of excess.

The amount of error above referred to, will then be equal to the content of a prism having for its base the triangle R O A, and for its length, that of the interval of cutting of which it is a component part: this supposes the height of the cutting at each end to be the same. Where the transverse slope is very gentle, as 1 in 30 or 1 in 20, the error is not considerable; but where it is steeper than 1 in 10 it is worth the trouble of correction.

Suppose a base of 30 feet with side slopes 2 to 1, height of cutting 50 feet, and transverse slope of surface 1 in 10—Upon a content of 240·74 cube yards there is a surplus or error of 10·20 cube yards wanting by the table, which is about one twenty-fourth part of the whole.

The table here given has been calculated for this correction. It is made

to suit three of the most general slopes:—The first is 1 to 1, the second 1½ to 1, and the third 2 to 1, all on a 30 feet base—these being the most common and useful cases.

In this table the first column is the height of cutting or filling, in intervals of six inches, which for the purposes of this correction are considered sufficiently accurate.

The second column expresses the content in cube yards of a lineal foot of the section in level ground, the end heights being the same.

The other twelve columns being for different transverse slopes, as headed, shew the amount of error, or quantity to be added in sloping ground to the amount made out from the tables for horizontal ground; this amount being expressed in cube yards for one foot in length, according to the height and slopes given.

The content by all the usual tables is calculated as if the section were level across: to find the addition to be made to this content apply the following

RULE.

In the page headed with the side slope—find the height of cutting in the left hand column, and the given ground slope in the headings—a tabular number will be found at the intersection of the two lines, which when multiplied by the length, gives the amount of error or correction to be added for the ground slope.

EXAMPLE I.

Suppose a piece of cutting 200 feet long to be made in ground which slopes transversely 1 in 10, breadth of base 30 feet, side slopes 1½ to 1, and height at each end 20 feet—Required the additional quantity of earthwork caused by the sloping of the ground surface.

Opposite 20 feet in the heights in the column of ground slopes 1 to 10 is	1·15	
Multiply by the length	200·	
To be added	230·00	
The amount of the above cutting as made out by Table II.	8888·00	
Total	9118·00	cube yds.

Here in a cutting of ordinary dimensions, the error caused by assuming the cross section to be level amounts to 230 cube yards in 8888, or one thirty-ninth part of the whole.

EXAMPLE II.

Required the additional quantity of Earthwork to be added for the slope of the ground, in an Embankment constructed where the transverse slope is 1 in 6, the length being 200 feet, breadth of roadway 30 feet, and side slopes 2 to 1; also height at each end 40 feet.

Opposite 40 feet in side column, and in column 1 to 6 is found the tabular number ...	20·89	
Multiply by the length	200·	
Required addition	4178·00	
Content by Table II	32593·00	
Total ...	36771·00	cube yards

In this case the error of ordinary tables is 4178 cube yards, or about one-eighth part of the whole.

As the second column in the table expresses the quantity of the given section in cube yards for one foot of the length, taking the cross section as level, and every other column in the ground slopes expresses the amount of the triangle of excess also in cube yards for a foot of the length—the amount of the error as compared to the whole can be made out by inspection of the table. Thus, in the case above-mentioned—

Opposite 40 feet in the second column is	162·96
Opposite same in column 1 in 6 is	20·89

Showing that in this case the error is nearly 21 cubic yards in 163 or about one-eighth part, to be added.

To Find the Content of a Piece of Earthwork in Level Ground from this Table.

RULE.—Having opened the page for the proper side slope, seek the height in the side column, and opposite this in the second column is a tabular number; multiply this by the length in feet, for the content in cube yards.

Suppose the same dimensions as in Example II, all but the ground slope—

Opposite 40 feet, the height, in second column is ...	162·96
Multiply by the length	200.
Content in cube yards ...	32592·00

To Find the Whole Content in Sloping Ground by this Table.

In Example II above—

Opposite 40 feet in second column is	162·96
Opposite same in column 1 in 6, to be added for correction for ground slope	20.89
	183·85
Multiply by the length	200·
Total content in cube yards ...	36770·00

In both the above cases, this is by much the shortest way of coming at the content of these pieces of earthwork, which is done truly at once, without requiring further correction and without reference to any other table; but it must be remembered, that this rule applies only where the heights are equal at both ends, or where they are nearly so. Where the difference of the heights increases, an error by this rule increases, which renders it inadmissible in such cases.

To show how far a deviation from equal heights might safely be made, the following trials were made. Following Example 2, as above, and calculating the contents by Table II and the formula (p. 60), when the

	Content in Cube Yards	Amount of Error
Heights are 40 feet at each end	36771	0
When they are 38 and 42 feet	36792	1 in 1752
When „ „ 36 and 44 „	36858	1 in 422
When „ „ 34 and 46 „	36968	1 in 186
When „ „ 32 and 48 „	37129	1 in 103

By inspection of the above it will be seen, that where the heights are 36 and 44, that is, the difference is 8 feet or one-fifth of the average height, the error is only 1 cube yard in every 422 obtained by the above rule, which is not considerable in approximations; but farther than this, or at least where

the difference of the heights exceeds one-fourth of the average, it would not be safe to use this rule. In this case of equal heights also, although the base in all the divisions of the table is made out at 30 feet, yet by the help of Table III or the Core Table, all breadths of base from 20 to 40 feet can be calculated.

Keeping all the conditions and dimensions in Example II, except the base, which suppose now to be 26 instead of 30 feet as in the table, this is done by taking 4 feet of the core from the Tabular Number for 30 feet, thus—

Opposite 40 feet in second column of Table IV is	162·96
Opposite same in ground slope 1 in 6 is 20·89, which add	20·89
Tabular Number for 30 feet base	183·85
Deduct number for 4 feet wide at 40 feet high in Table III	5·926
Remainder is the Tabular Number for 26 feet	177·924
Which multiply by the length	200·
Gives the content in cube yards	35584·800

Again, suppose the base 36 feet, and all the other dimensions the same as in the above example—

Tabular Number for 30 feet base as above	183·85
Add for core 40 feet high as found in column of 6 feet base, Table III.	8·889
	192 739
Multiply by length	200.
Content for a 36 feet base	38547·800

It is hoped that this table, embracing as it does some of the most common and ordinary cases, will be found useful. To reach every case would require an extension of it to so many pages that it cannot be attempted here; but any person who may require a table for a case not to be found in this one, by the following explanation of the principle, may calculate one to suit his peculiar purpose.

The formula for this correction may be expressed in general terms thus—(Plate 1, Fig 4)—taking G to represent the ratio of slope of the ground line A E; S the ratio of the side slopes; B the base or breadth of the roadway; H the height of cutting or embankment, the area of the triangle of excess $ROA = S \times \frac{(\frac{1}{2}B+HS)^2}{G^2-S^2}$ *; and taking L for the length of cutting in feet, the

---

* The above formula is thus demonstrated, referring to the diagram—

Let $TE = p$, then $p \times G = FT$, and $p \times S = TK$.

Add these, and $p\,(G+S) = FT+TK = FK$.

But $FK = FN+NK = \frac{1}{2}B+HS \therefore p\,(G+S) = \frac{1}{2}B+HS$.

and $p = \frac{\frac{1}{2}B+HS}{G+S}$

The area of the triangle FEK, is $\frac{FK \times ET}{2}$

$= \frac{1}{2}FK \times p = \frac{\frac{1}{2}B+HS}{2} \times \frac{\frac{1}{2}B+HS}{G+S} = \frac{(\frac{1}{2}B+HS)^2}{2\,(G+S)}$

Similarly the triangle $FOA = \frac{(\frac{1}{2}B+HS)^2}{2(G-S)}$

and the difference of these triangles, or the triangle ROA

$= \frac{(\frac{1}{2}B+HS)^2}{2(G-S)} - \frac{(\frac{1}{2}B+HS)^2}{2(G+S)} = S \times \frac{(\frac{1}{2}B+HS)^2}{G^2-S^2}$.

content of the prism of excess in cube yards $= L\ S \times \frac{(\frac{1}{2}B + H\ S)^2}{27(G^2 - S^2)}$

which in words gives the following RULE—

1. To half the breadth of base or roadway, add the product of the height, and ratio of the side slopes: (this gives the line F O, which is half the horizontal breadth at the top of the cutting, or base of embankment.)
2. Square the sum so obtained, and divide the product by the difference of the squares of the numbers expressing the ground and side slopes.
3. Multiply the quotient by the ratio of the side slopes, and that by the length in feet, and one-twenty-seventh of the product will be the additional quantity required, in cube yards.

EXAMPLES.

Suppose a Cutting to be made in ground the surface of which slopes across, 1 in 10, breadth of base 30 feet, side slopes $1\frac{1}{2}$ to 1, and height at each end 20 feet—Required the Tabular Number for this.

Half breadth of Base	=	15	Ground Slope squared $=10^2=$	100
Height 20 feet $\times 1\frac{1}{2}$	=	30	Side Slope squared $=1\frac{1}{2}^2=$	2·25
		45	Difference	97·75
		45		
		225		
		180		
		2025		
2025 divided by 97.75		=	20.716	
Multiply by ratio of Side Slope, $1\frac{1}{2}$			10.358	
			31.074	cube feet
		or divided by 27,	1.1508	cube yards
Or as entered in its place in the Table			1.15	

Again. Suppose an Embankment with the following dimensions—Transverse slope of the ground 1 in 6, breadth of roadway 30 feet, side slopes 2 to 1, height at each end 40 feet.

Half breadth of Roadway	=	15	Ground Slope squared $=6^2=$	36
Height 40 $\times 2$	=	80	Side Slope squared $=2^2=$	4
		95	Difference	32
		95		
		475		
		855		
		9025		
9025 divided by 32	=		...	282.031
Multiply by ratio of Side Slope				2
				564.062
		Divide by 27,	=	20·891

Or 20.89 as found in the Table for 2 to 1 opposite 40 feet high, and in column 1 in 6.

The Table was constructed by this method with the assistance of logarithms, at intervals of five feet, and then filled in by interpolation.

The blanks in some of the columns occur in those cases in which the

surface of the ground intersects the roadway, in which case the latter is formed partly in Side Cutting and partly in Embankment. This will be fully explained in Table V. which is adapted to this purpose.

Where the heights at the ends are unequal, the true additional content would be that of the frustum of a pyramid having the same length as the prism of excess referred to, and terminating at one end in the same triangle; but at the opposite end in a triangle either greater or less, as the height at that end is greater or less than the height at the first end:—The content of this frustum in cube yards, taking h for the lesser height:

$$= \tfrac{1}{2}\,L\,S \times \frac{(\frac{1}{2}B + H\,S)^2 + (\frac{1}{2}B + hS)^2 + (\frac{1}{2}B + HS).(\frac{1}{2}B + hS)^*}{27\,(G^2 - S^2)}$$

Having thus obtained a method of finding the true correction when the heights are different, it remains to shew the amount of error involved by taking an average of the two unequal heights, and working with that average as if it were the height at each end.

Required for instance the true additional content in a cutting the depths of which at the ends are 18 and 22 feet, length 200 feet; transverse ground slope 1 in 10, breadth of Base 30 feet, and side slopes $1\frac{1}{2}$ to 1.

Applying the preceding formula the addition is

$$\frac{200 \times 1\frac{1}{2}}{3} \cdot \frac{(15 + 22 \times 1) + (15 + 18 \times 1\frac{1}{2})^2 + (15 + 22 \times 1\frac{1}{2})(15 + 18 \times 1\frac{1}{2})}{27(10^2 - 1\frac{1}{2}^2)}$$

$= 230{\cdot}520$ cube yards.

Supposing each of the end heights to be 20 feet, the average of the two above mentioned, the amount of error as found by Table IV. would be 230 cube yards, making in this case a difference of only half a cube yard—shewing that where the heights are nearly the same this correction is inconsiderable, and may be made out by Table IV, sufficiently accurate.

As another Example:—Required the additional quantity of Earthwork arising from the transverse Slope of the ground, in an Embankment the heights of which are 30 and 50 feet, the transverse slope of the ground 1 in 6, the Length 200 feet, Breadth of roadway 30 feet, and side Slopes 2 to 1.

The correction by the formula is

$$\frac{200 \times 2}{3} \cdot \frac{(15 + 50 \times 2)^2 + (15 + 30 \times 2)^2 + (15 + 50 \times 2)(15 + 30 \times 2)}{27(6^2 - 2^2)}$$

$= 4240$ cube yards.

The correction corresponding to the average height 40 feet, as already calculated from Table IV. in page 56, amounts to	...	4178
	Difference	62 Cube Yards.

---

* The areas of the ends of the frustum are, as demonstrated previously,

$$S \times \frac{(\frac{1}{2}B + H\,S)^2}{G^2 - S^2} \quad \text{and} \quad S \times \frac{(\frac{1}{2}B + h\,S)^2}{G^2 - S^2}$$

And the sum of these areas added to the square root of their product, and multiplied by one-third of the length (according to the ordinary rule for the content of such a solid) gives for the content in cube yards—

$$\frac{L}{3 \times 27}\left\{ S \times \frac{(\frac{1}{2}B + H\,S)^2}{G^2 - S^2} + S \times \frac{(\frac{1}{2}B + h\,S)^2}{G^2 - S^2} + S \times \frac{(\frac{1}{2}B + H\,S) \cdot (\frac{1}{2}B + hS)}{G^2 - S^2} \right\}$$

$$= \tfrac{1}{2}LS \times \frac{(\frac{1}{2}B + H\,S)^2 + (\frac{1}{2}B + h\,S)^2 + (\frac{1}{2}B + H\,S) \cdot (\frac{1}{2}B + h\,S)}{27\,(G^2 - S^2)}$$

The total content of the Embankment, when 4240 cube yards is added to the result of Table II, is 37329 cube yards ; so that in this case the deficiency amounts to 62 cube yards in 37329, or 1 cube yard in 602. Thus it is seen, that even in this case which is an extreme one, the heights being widely different, this correction is not considerable; and that *the addition* for sloping ground in all cases may be made by Table IV, with sufficient accuracy, by entering the table with the *average* height.

There is however another point to be taken into consideration here, and that is, where the ground slopes on the longitudinal section vary. Where a piece of cutting has one ground slope at one end, and another at the other, the surface is not a plane, and no rule can reach this case. For calculation of the content of such a solid, an approximation may be made by taking the average of the ground slopes at both ends, and using this average as in an ordinary case.

TABLE V.

Where a Road is formed in sloping ground along the side of a hill or valley, it is said to be in SIDECUTTING. In such cases there is usually a power of keeping the line higher or lower on the sloping surface, so as to suit a general gradient; and it may be said that in such work the cutting or embankment is never considerable, and for common roads, the surveyor usually makes his estimate for Forming, by the perch or chain in length, which is more or less according to the slope of the ground and other circumstances ; but should the work be heavy, or accurate data be required, this mode of working would not answer.

The surveyor's data here should be—(see Plate 1, Fig. 5).

1. A section along the centre line of the road, from which the breadth of base of the cutting D C or D N is afterwards determined.
2. The breadth of the intended road D E.
3. The ratio of the ground slope A B.
4. The ratio of the side slopes of the cutting and embankment A D & E B

Let A B represent the transverse section of the ground, at right angles to the direction of a road—

The Section of the Cutting will be the Triangle A D C, and that of the Embankment, the Triangle C E B. The Sections at the other end of a given length may be represented by the Triangles O D N and N E P.

The form of this piece of Cutting or Embankment is that of a frustum of a pyramid, and its content in the usual way is found by adding together the end areas and the square root of their product, and multiplying the sum by one third of the length. After considering this subject, it was found convenient to construct the Table independently of the slopes either of the sides, or of the transverse section of the ground, leaving room for all possible varieties of these in a separate operation; the chief element on which it is founded being the breadth of the Base of the Cutting measured on the plane of the road.

The Table consists of a column of figures down at the left hand side,

which represents the breadth of the cutting at one end measured on the level of the roadway; and another column along the top line from 0 to 47 feet, which represents the breadth of the base at the other end. Considering the irregularity generally of ground which slopes transversely, it is thought sufficiently accurate in constructing this Table to make the intervals of breadths of Base at one foot: The figures in all the other columns are the Tabular Numbers corresponding to these two, which, for the particular breadths required, are found at the intersection of the two lines of figures.

The heading columns are denominated in the Tables as Base of Cutting, but they may also be termed Top of Embankment, if the quantity of embankment be required. As the breadth of base of the cutting cannot be ascertained by the Surveyor in the field, this depending on the gradients as determined on the longitudinal section, it must be deduced from the height of cutting or filling on the middle line, and may be made out by the following

RULE FOR FINDING THE BREADTH OF BASE OF THE CUTTING.—

Multiply the depth of cutting on the centre line by the ratio of the ground slope, and *add* the product to half the breadth of the road; or, if the depth on the centre line be embankment, *subtract* it:—

Thus (in Plate 1, Fig 5,) D C the breadth of the cutting, is equal to half the width of the roadway D F *plus* the distance F C from the centre of the roadway to the edge of the cutting; and F C is determined by multiplying the height F K by the ratio of the slope of the ground surface as set forth in the rule. Also D N, the other end breadth, is equal to D F *minus* the distance F N, which is found by multiplying the height F M by the ratio of the ground slope.

The breadths of the embankment C E and N E are found by taking the breadths of base of cutting from the whole breadth of the road, that is D E—D C = C E, and D E—D N = N E.

RULE FOR USING TABLE V.

1. Find the breadth of Base of the Cutting at each end, according to the rule already given.
2. Multiply the Tabular Number corresponding to the two Bases, as found in the top and side columns of the Table, by the length of the cutting in feet, and divide the product by the difference of the ratios of the ground and side slopes—The quotient is the required content in cube yards.

EXAMPLE.

Required the quantity of cutting in a Road, the longitudinal section and dimensions of which are represented in Plate II Fig 1; the breadth of the road is to be 30 feet, the side slopes 1 to 1 in cutting, and 1½ to 1 in embankment, and the transverse slope of the ground 1 in 5.

In works of this kind, as the engineer usually regulates his gradients so as to have about enough of cutting to form the embankment by removing a short distance, it is not generally necessary to calculate the quantity of embankment.

FORM FOR CALCULATION OF CUTTING.

Number of Division	Length	Side Slopes	Ground Slope	Heights on Centre Line	Breadths of Bases of Cutting	Tabular Number	Content in Cube Yards
1	150	1 to 1	1 in 5	$\frac{3}{2}$	$\frac{30}{25}$	14·04	526
2	370	1 to 1	1 in 5	$\frac{2}{-1}$	$\frac{25}{10}$	6·02	557
3	185	1 to 1	1 in 5	$\frac{-1}{0}$	$\frac{10}{15}$	2·93	135
4	172	1 to 1	1 in 5	$\frac{0}{2}$	$\frac{15}{25}$	7·56	325
							1543

Where the Content of the Embankment also is required, the following form may be used where both are combined.

Number of Division	Length of Cutting & Embankment.	Side slopes	Ground Slope	Heights on Centre Line	Breadths of Cutting or Embankment	Tabular Number	Content of Cutting	Content of Embankment.
1	150	1	5	$\frac{3}{2}$	$\frac{30}{25}$	14·04	526	...
	150	1½	5	...	$\frac{0}{5}$	0·15	...	6
2	370	1	5	$\frac{2}{-1}$	$\frac{25}{10}$	6·02	557	...
	370	1½	5	...	$\frac{5}{20}$	3·24	...	342
3	185	1	5	$\frac{-1}{0}$	$\frac{10}{15}$	2·93	135	...
	185	1½	5	...	$\frac{20}{15}$	5·71	...	302
4	172	1	5	$\frac{0}{2}$	$\frac{15}{25}$	7·56	325	...
	172	1½	5	...	$\frac{15}{5}$	2·01	...	99
							1543	749

In the first of the preceding forms, the data as taken from the longitudinal section of the road are first entered. For convenience of reference the several divisions are numbered in succession, and these numbers are entered in the first column; in the second are entered the lengths of the divisions; in the third, the side slopes; the fourth column contains the ratio of the ground slope; the fifth contains the heights on the centre line above or below the plane of the road—the first being written over a line, and the second or the height at the other end under it; the breadths of the bases of the cutting are entered in the sixth column in a similar manner—the breadth of base at one end being written over the line, and that at the other end under it; the seventh column contains the numbers as taken out of the table; and the eighth, the contents of the cutting.

In the second form, eight of the columns are similar to those just described in the first. The ninth column is for the quantity of the embankment.

The following description for the second form, will answer for both.

After the five first columns are filled from the longitudinal section and the other data, the sixth or breadths of bases must be calculated and entered thus—

For the First Division.

The first height 3 feet, is multiplied by 5 the ground slope, and the product 15, added to half the breadth of the road, makes 30 feet for the breadth of base of the cutting, or the whole roadway. This is placed opposite 3 feet. The breadth of cutting at the other end of the division is 25 feet as calculated in a similar way; the tabular number corresponding to these two, 14·04, is taken from the 30 feet base column of the table opposite 27 feet in the side column, or from the 27 feet column opposite 30 feet. It is placed in the seventh column or that for tabular numbers, and is then multiplied by the length 150 feet, and divided by 4 the difference of the ground and side slopes —the quotient 526 is the content in cube yards of the cutting, which is entered in the column for cuttings.

The breadth at the top for the embankment, will be the breadth of the road, minus the breadth of the cutting, and will be 0 and 5 at the two ends, the tabular number for which is 0·15; multiply this by 150 the length, the product is 22·50, which divide by 5 minus $1\frac{1}{2}=3\frac{1}{2}$, the difference of the ground and side slopes; the quotient is 6 cube yards, the content of the embankment, which is put into its proper column in the form.

For the Second Division.

In this division, the first height is 2 feet of cutting; this multiplied by the ground slope 5, and the product added to 15 half the breath of the roadway, gives 25 for the base of the cutting at that end, as previously calculated in the first division. The height on the middle line at the opposite end is in Embankment, and the breadth of Cutting will be less than half the width of the roadway; consequently, the Base of Cutting at that end is found by deducting the product of 5 and 1 the Ground Slope and Depth of Embankment from 15, the remainder 10 being the breadth of cutting here. The sign *minus* is placed before the height 1, on entering it in the form, to shew that this height is in Embankment, and that the result obtained from it must be deducted from the half breadth of the road, and not added as is the case when the height is in Cutting. The Tabular Number for 25 and 10 is 6·02, which is multiplied by 370, and divided by 4—The quotient 557, is the Content of the Cutting in cube yards.

The Breadths of Embankment for the second division are 5 and 20, the complements of the Bases of Cutting to 30 the breadth of roadway; the corresponding Tabular number to which is 3·24, which is multiplied by the length 370 feet, and the product 1198·80 divided by $3\frac{1}{2}$—the quotient is 342, the Content in cube yards of the Embankment in this division.

The Third and Fourth Divisions

are proceeded with exactly in the same manner, and it is therefore considered unnecessary further to describe the operation of working them out.

There is another and an important point to be considered here, which was noticed also in the observations on Table IV., that is—Where the ground slopes vary along the section (which must frequently happen in selecting lines of road through uneven ground,) a division of cutting has one ground slope at one end and another at the other end, and there is no rule for cal-

culating the solid truly; but an approximation may be made by taking the average of the ground slopes at both ends, and using that average when dividing by the difference of the ground and side slopes, according to the rule. The breadths of base, however, of the cutting, as entered in the form below, are correctly calculated with the true ground slope proper to each end.

Taking the same Section as chosen for a former Example, PLATE II. Fig. 1, but writing on it the ground slopes at the end of each division for clearness, as in PLATE II. Fig 2—the following form will shew the calculation in this case.

FORM FOR CALCULATION.

Number of Division	Length	Side Slopes	Ground Slopes	Heights on Centre Line	Breadths of Cutting or Embankment.	Tabular Number	Average Ground Slope	Content of Cutting	Content of embankment
1	150	1	$\frac{4}{5}$	$\frac{3}{2}$	$\frac{27}{25}$	12·52	4½	537	
	150	1½	...	...	$\frac{3}{5}$	0·30	4½		15
2	370	1	$\frac{5}{8}$	$\frac{2}{-1}$	$\frac{25}{7}$	5·24	6½	352	
	370	1½	...	...	$\frac{5}{23}$	4·13	6½		306
3	185	1	$\frac{8}{6}$	$\frac{-1}{0}$	$\frac{7}{15}$	2·34	7	72	
	185	1½	...	...	$\frac{23}{15}$	6·78	7		228
4	172	1	$\frac{6}{5}$	$\frac{0}{2}$	$\frac{15}{25}$	7·56	5½	289	
	172	1½	...	...	$\frac{15}{5}$	2·01	5½		86
								1250	635

The above form is the same as the second in every respect, except that of adding the eighth column for the average ground slopes, which (in applying the *second* part of the Rule for Table V) are used in place of the true ones, for the reason stated.

Where the breadth of base of the cutting or embankment as calculated, *exceeds* the breadth of the roadway, the table is not applicable, inasmuch as the road is no longer in side cutting: Tables II and IV are then to be used; and the point on the section at which this change begins, is where the breadth of cutting or embankment is equal to the breadth of the road.

METHOD OF CALCULATING THE TABLE.

The top and side columns are first filled in with the different bases, increasing by intervals of one foot in succession, from 0 to 47, in the horizontal line at top which extends through the whole four pages of the table; and from 0 to 50 in the first vertical column of each page.

The RULE for calculating the tabular numbers is as follows:—

Multiply the breadths of the bases of cutting at both ends together, and to the product add the squares of both numbers; this sum divided by 6 and by 27, gives the tabular number.

EXAMPLE.

Suppose 29 feet the breadth of base at one end, and 44 feet the breadth at the other—

$$29 \times 44 = 1276$$
$$29^2 \ \ldots \ = 841$$
$$44^2 \ \ldots \ = 1936$$
$$4053$$

Divide 4053 by 6, and the quotient by 27, the last result is 25·02, the tabular number sought.

The above rule is the same in principle as the ordinary rule for finding the content of the frustum of a pyramid, but is modified so as to find the content in cubic yards from terms of the given dimensions.

An inspection of the formula below* will explain both this rule and that for using the Table as given in page 62.

TABLE VI.

This table is intended for the calculation of the quantity of land required for a Road. This quantity will depend on the breadth of roadway, the depth of cutting or embankment, and the ratio of the side slopes.

The table consists of two columns of figures—one extending from 0 to 50 feet, in intervals of three inches; the other containing the corresponding tabular numbers. In the first column is found either the breadth of roadway or the sum of the end heights, and hence it is termed Base or sum of Heights, as it will answer for either.

RULE FOR USING TABLE VI.

1. Find the tabular number corresponding to the given breadth of roadway.
2. Find also the tabular number corresponding to the sum of the end heights, and multiply it by the ratio of the side slopes.

---

* PLATE I. Fig. 5. Let B and b =, the breadths of the base of the cutting at the opposite ends, L the length, and G and S the ratios of the ground and side slopes as before;

Then $AQ \times G = QC$ and $AQ \times S = QD$

Subtract the latter equation from the former, and

$$AQ \times (G - S) = QC - QD = DC = B \quad \therefore AQ = \frac{B}{G - S}$$

The triangle A D C is $\therefore = \frac{B}{2} \times \frac{B}{G - S} = \frac{B^2}{2(G - S)}$

Similarly, the triangle O D N $= \frac{b^2}{2(G - S)}$

And the sum of these areas added to the square root of their product, and multiplied by one-third of the length, and divided by 27 = the content of the frustum in cube yards

$$= \tfrac{1}{3} L \frac{B^2 + b^2 + B\,b}{2\,(G - S) \times 27} = \frac{B^2 + b^2 + B\,b}{6 \times 27} \times \frac{L}{G - S}$$ which affords the Rule for using the Table, (p. 62.)

The first factor of this expression, $\frac{B_2 + b^2 + B\,b}{6 \times 27}$ is that which is represented by the Tabular number, and from which is deduced the above Rule for calculating the Table.

In applying the formula to embankments, B represents the breadth at top.

3. Add together the two numbers thus obtained, and multiply the sum by the length in feet; then the product divided by 100 will be the content in acres and decimals.

The table is divided into two parts—one for statute or English acres, the other for computing the area in Irish acres; and whether the content be required in English or Irish acres, the tabular numbers must be taken from the corresponding part of the table accordingly.

Example.

Required the number of statute acres necessary for 300 feet in length of a road, the breadth of which is 30 feet, the heights of embankment 20 and 30 feet respectively, and the slope of the sides 1½ to 1.

FORM FOR THE CALCULATION IN ENGLISH ACRES.

Length.	Base & Heights	Tabular Numbers	Results
300	30	0·0688	0·0688
	$\frac{20}{30}$	0·1147×1½	0·1720

0·2408 × $\frac{300}{100}$ length

3

0·7224 acres

4

2·8896 roods

40

35·5840 perches

Area required, 0A 2R 35P Statute Measure.

FORM FOR THE SAME IN IRISH ACRES.

Length	Base & Heights	Tabular Numbers	Results
300	30	0·0425	0·0425
	$\frac{20}{30}$	0·0708×1½	0·1062

0·1487 × $\frac{300}{100}$ length

3

0·4461 acres

4

1·7844 roods

40

31·3760 perches

Area required, 0A 1R 31P Irish Measure.

In the first column of the above form is entered the length 300 feet, and in the second, the breadth of roadway 30 feet, with the heights of em-

bankment 20 and 30 feet. Opposite 30 feet in the table for English acres is 0·0688, which is placed in the third column opposite 30, and also in the fourth column or results; and opposite 50 the sum of the heights is 0·1147, which is entered under the former tabular number, to be multiplied by 1¼ the ratio of the side slopes; the product 0·1720 is placed in the fourth or result column also. The sum of these is 0·2408, which is to be multiplied by 300 feet the length, and divided by 100, giving the required area 0·7224 statute acres, or 2 roods and 35 perches.

The form and operation for finding the content in Irish acres are the same, only the tabular numbers are taken out of the division of the table for Irish acres; the description need not therefore be repeated.

It remains to be observed, that when the sum of the heights exceeds 50 feet, the tabular number answering to half that sum should be multiplied by twice the ratio of the side slopes for the correct result; also, should the opposite slopes differ in their rate of inclination, the average of the two ratios is that which is to be made use of in the calculation.

The following is an explanation of the

METHOD OF CALCULATING THE TABLE—

To ascertain the quantity of land included between any two sections, the top breadth of the cutting, or base of embankment, at each section must be known: half the sum of these multiplied by the length of interval between the sections, will give the area required. Let L represent the length, B the breadth of roadway, S the side slope, H the greater height, and h the lesser height;—

The expression for this area is $L.\{B+S(H+h)\}$* which, when divided by 43560 to reduce square feet to English acres, becomes

$$L.\left\{\frac{B}{43560}+S\frac{H+h}{43560}\right\}$$

The tabular numbers may therefore be calculated, by dividing by 43560 a series of numbers which may be termed either as bases or sums of heights: for Irish acres the divisor should be 70560.

It is evident from the formula, that the tabular number for the sum of the heights must be multiplied in each case by the ratio of the side slopes. The tabular number for 30 when thus calculated would be—

30 divided by 43560 = 0·000688

and for 50 it would be 0·001147

Were all the tabular numbers thus calculated to six places of decimals, it would be found that the first two decimals in each case would be cyphers; and to avoid so many unnecessary figures in the operation, the tabular number as made out from the formula is multiplied by 100, which reduces the decimal places from six to four. The compensation for this is performed afterwards, by dividing the result of each calculation by 100, or removing the decimal point two places to the left.

---

* PLATE 1, Fig 2. The breadth $DO=AC+DN+IO=AC+2IO=B+2HS$

Similarly the breadth $FE=B+2hS$

But the area required $=\frac{DO+FE}{2}\times$ Length

$$=\frac{B+2HS+B+2hS}{2}\times L=L\{B+S(H+h)\}$$

SCALE

FOR TRANSVERSE SECTIONS.

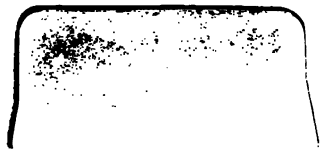
The Scale represented in Plate II Fig 4 may be used advantageously where many cross sections are required for a road ; it is made of transparent horn.

The part above the central horizontal line A B is used altogether in cuttings, and the part below this line for embankments. C represents the centre, and A B the breadth of the roadway ; B E, B F, A H, and A I, &c, the side slopes, when in cutting ; and B L, B M, A O, and A P, &c, the slopes in embankment. The lines C R, and C Q, are graduated at 20, 30, or 40 feet to the inch, according to the scale required for the cross sections ; on these scales are measured the depths of cutting or embankment on the centre line, at the given cross section. The points E, F, H, I, &c, are perforated on the inner line round the margin, to allow the point of a needle to be driven through them ; as are also the points A and B.

Directions for Using this Scale.

Plate II Fig 3.—Suppose T S to be the transverse section of the ground at any given point on the longitudinal section, where the depth of cutting is say 5 feet. Then to draw the cross section of the proposed road, place 5 feet on the scale for cuttings on the point V, which is supposed to be the centre of the road, and make the line R Q on the scale coincide with the vertical line X V Y, then mark the points A and B on the drawing with the steel point through the holes in the scale. If the ratio of the side slopes be 1 to 1, mark also the points I and F at *i* and *f* ; join these points, and the required cross section *a b h g* will be obtained in its true position with relation to the surface of the ground and depth of cutting. Were the road to be constructed with five feet height of embankment at the same place, 5 feet on the scale for embankment should be placed over the point V, and the points A B P M marked on the paper and joined.

The work when done may be readily checked by the application of the scale ; for the base and slopes as drawn on the paper should coincide with the corresponding lines on the scale. Aided by it, a draftsman can draw more transverse sections in a day than he could in several days in the ordinary way.

Scales on this principle may be made for various purposes. Another form may be used for showing the proposed alterations in the surface of a road, when crossed by a railway or another road at a different level ; also for cross sections of roads in sidecutting.

THE END.